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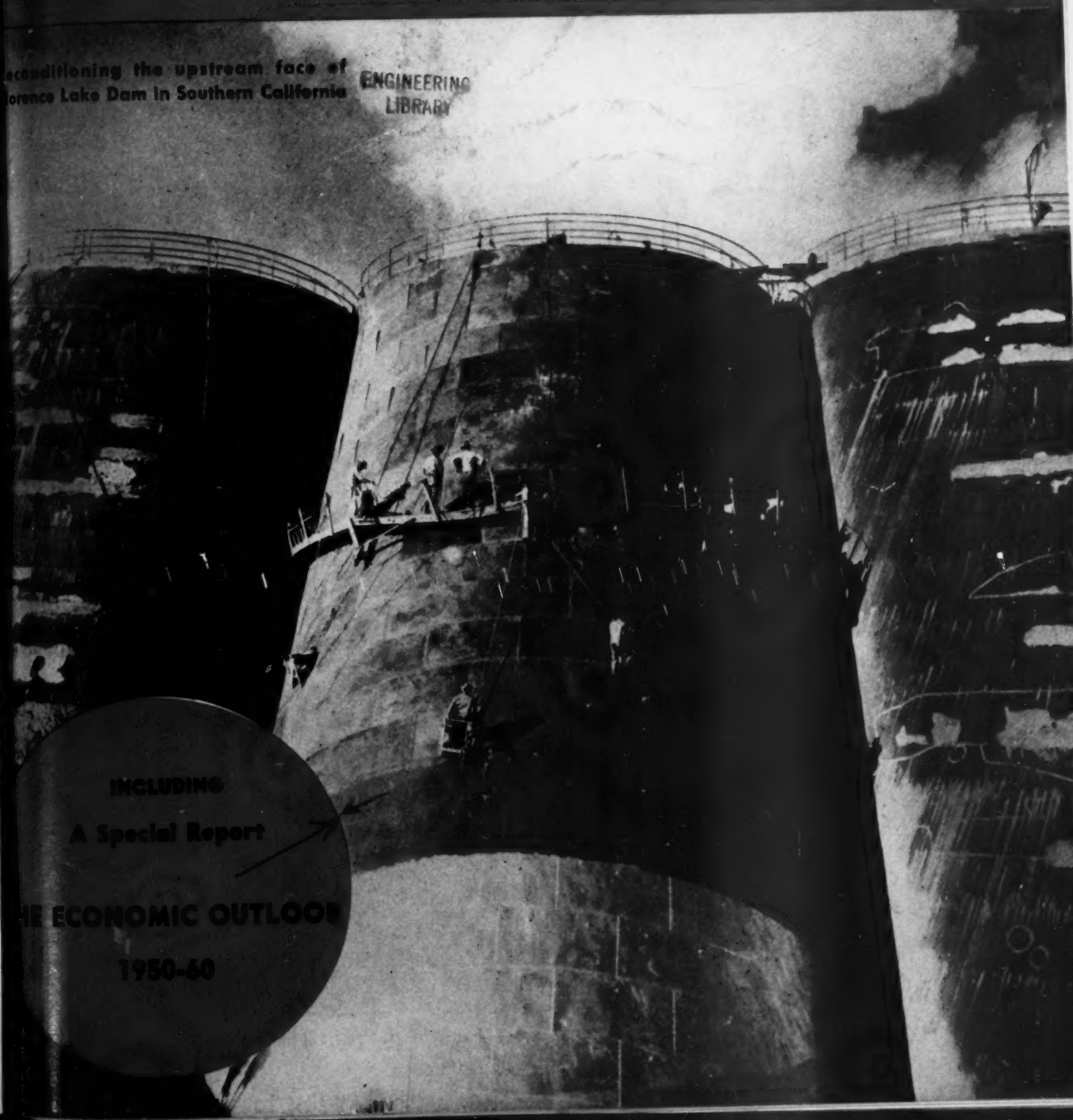

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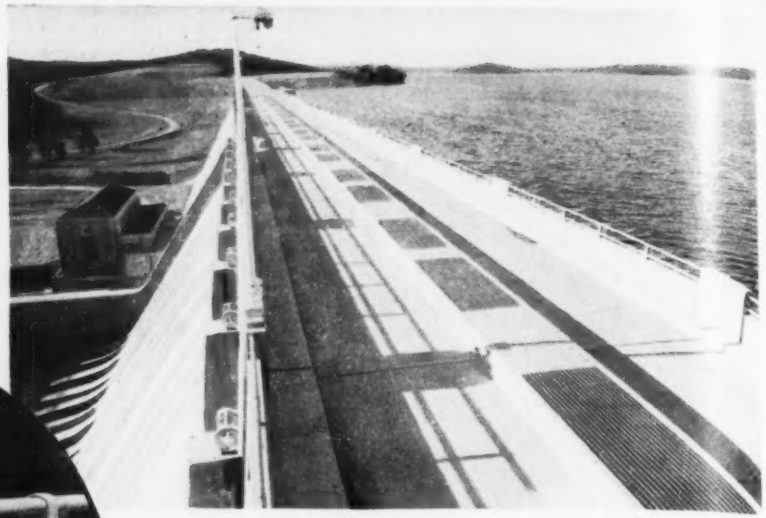

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Volume 138 • Number 20 May 15, 1947

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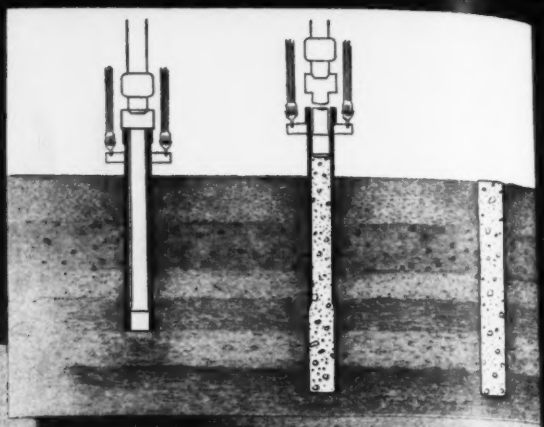
Foundation Security



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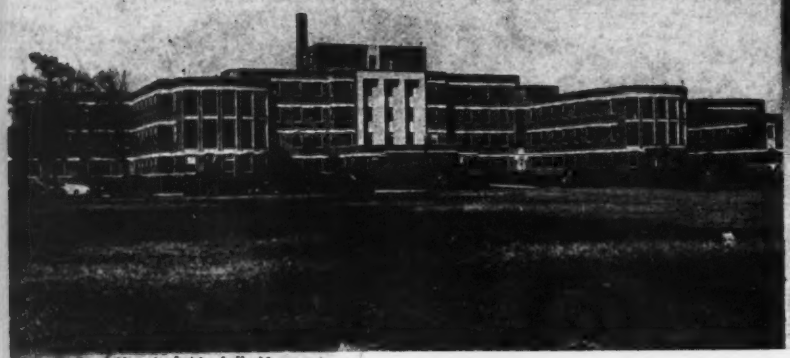

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Construction Trends

Private Investment 84% Ahead of a Year Ago

New construction capital available from private sources, amounting to $518,200,000 for the first four months of 1947, rose 84 percent above the $281,600,000 available in the corresponding period of 1946. If the present rate of investment continues throughout the remainder of 1947, total new construction capital from private sources may exceed all previous years on record, with the exception of 1930, when approximately $3,500,000,000 was available for new construction.

The record low for private capital investment was reached in 1943, when private investments totaled $153,000,000. Since that time, private capital invested in the construction industry has made steady gains with the rate of increase showing marked acceleration in 1946 and 1947. New private capital investments rose to $305,400,000 in 1944, to $610,600,000 in 1945 and to $1,509,700,000 in 1946.

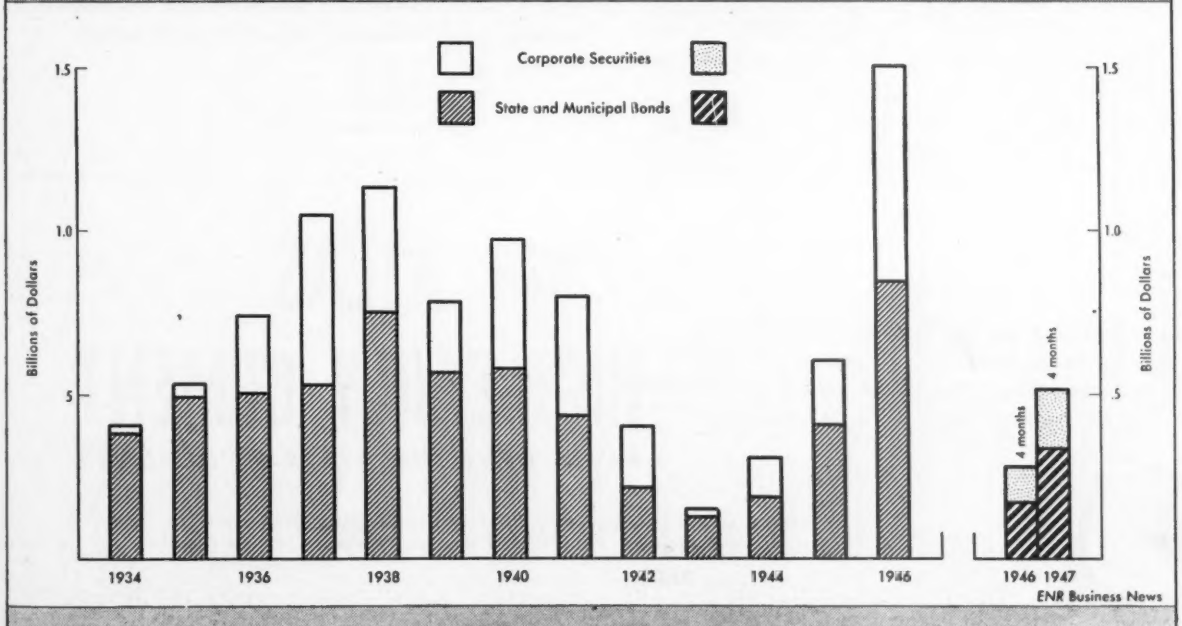
Of the total private construction capital available in the first four months of 1947, 64 percent went into state and municipal bonds and the remaining 36 percent in corporate securities. These ratios compare with an investment of 62 percent in state and municipal bonds in the corresponding period of 1946 and with 38 percent in corporate securities.

State and municipal bonds, totaling $333,600,000 in the four-month period of 1947, were nearly double the $173,600,000 invested during the corresponding period of 1946. At the present rate of investment, new capital available to states and municipalities may approximate the 1930 high of about $1,500,000,000.

Construction capital invested in corporate securities rose to $184,600,000 for the first four months of 1947, a gain of 71 percent over the corresponding capital investment of $108,000,000 during this four-month period a year ago.

The volume of private, state and municipal construction that has been proposed through April, 1947, as recorded by *Engineering News-Record*, totals $29,500,000,000 in 1940, 1943, 1944, 1945, 1946 and 1947 construction dollars. With the rise in prices, capital needed to finance this new construction will more nearly approximate $35,500,000,000 and will have to be obtained either by direct appropriation out of income or reserves, or by borrowing.

TRENDS IN NEW CONSTRUCTION CAPITAL FROM PRIVATE INVESTMENT



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ENR-H-84

News of the Week

ENGINEERING NEWS-RECORD • MAY 15, 1947 • VOLUME 138 • NUMBER 20

Construction volume drops as costs continue upswing

Strikes and higher pay demands persist in face of reports of unemployment in building trades—some strike settlements noted on granting of pay boosts

Amid increasing reports of lagging construction business and of considerable unemployment in the building trades in a few areas, construction labor uncertainties continued as a chief topic of industry news last week.

Confirming a 22-city survey conducted by this journal a month ago (*ENR* April 3, vol. p. 489) the reports of serious decline in the amount of construction under way or planned were further reflected in construction volume indexes. According to the *Engineering News-Record* Business News Department, the week ending May 8 showed a drop of 31 percent in engineered construction volume under the corresponding week of 1946, and a 46 percent drop under 1946 in private construction volume.

Highlight of the week's developments was a report issued by building trades unions in New York City which indicated that more than 16,000 mechanics were already idle in the metropolitan area and that more unemployment could be expected unless current price trends are turned downward.

And a sidelight on the situation—but one that may have far-reaching consequences—was a decision by the State of Michigan to underwrite contractors' increased labor costs as a means of getting union builders back on their jobs at two state college buildings.

Unemployment in N. Y.

Citing a "buyers' strike" as one of the principal reasons for the layoffs, a survey conducted by the AFL Building and Construction Trades Council showed that more than 16,000 mechanics were out of work in the metropolitan area, most of them in the Borough of Manhattan. Similarly, a survey of suburban Westchester County, N. Y., showed several hundred building projects of all types shut down or progressing very slowly because of steadily increasing prices all along the line.

In other parts of the United States, too, reports of a parallel nature were being made. At Boston, Mass., unemployment in the building trades was said to be growing, builders at Toledo, Ohio; at Jacksonville, Fla., throughout Arizona and at Reno, Nev., reported they were considering complete shutdowns on their construction jobs because of slowing business.

Construction in other cities was shut down because of labor troubles. At St. Louis, Mo., where 1,000 members of three unions went on strike for higher pay May 1, several million dollars worth of construction was hampered. Negotiations for settlement of a strike of 2,000 Indianapolis carpenters over their demand for $2 per hour wages were said to be at a standstill.

Some settlements

Numerous strike settlements were reported, all on the basis of increased wages. These included:

An agreement granting a 10 percent boost to building tradesmen, and 15 percent to construction laborers, at Minneapolis, Minn.; granting of a 12½ cent per hour boost to clay products workers in Ohio; a 12½ cent per hour raise for carpenters at Fort Lauderdale, Fla.; a raise from $1.97½ per hour to $2.22½ for Indianapolis bricklayers; wage increases of 22 and 25 cents an hour for building trades workers and apprentices in Toldeo, Ohio; a 22½ cent an hour raise for painters at Atlanta, Ga. and a $2.10 per hour wage for plumbers at Dayton, Ohio.

In Arizona, the State Highway Commission adopted a minimum wage scale for all employees of political subdivisions of the state not operating on

(*Continued on following page*)

Seek removal of construction controls

Last week the House passed the Wolcott Bill (H. R. 3203), which would remove all major controls on construction and eliminate the Office of the Housing Expediter. However, early similar action by the Senate appears unlikely, Washington observers said.

Another recent major congressional development pertaining to housing included a favorable report on the comprehensive long-range Taft-Ellender-Wagner Housing Bill (S. 866) by the Senate Committee on Banking and Currency. Still another development is passage by the Senate of a bill (S. 854) authorizing the National Housing Agency to spend an additional $35,500,000 to convert war-time structures into temporary veterans housing. This raises the original estimated cost of the conversion program from $410,000,000 to $445,500,000, which will pemit 8,300 additional units to be completed.

As passed by the House, the Wolcott Bill would eliminate all allocations, premium payments, guaranteed markets, the non-housing limitation order vhp-1, and the restrictions that only one bathroom can be completed in building one-family dwellings, which must be limited to a floor area of not over 2,000 sq. ft.

In apparent anticipation of these measures, the office of the Housing Expediter May 12 announced relaxation of restrictions on space in new housing, permitting erection of houses having a maximum of 2,000 sq. ft. of floor space (previous limit was 1,500) where the builder needs extra room for family or business reasons.

The comprehensive long-range housing bill reported out favorably by the Senate banking committee makes the National Housing Agency a permanent organization, supplies federal aid for housing estimated by opponents of the bill at $7 billion, and establishes a comprehensive research program to aid housing construction.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction—Contract for a $2,500,000 building for the National Biscuit Co. at *Houston, Tex.*, has been awarded to the American Construction Co. . . . Robert & Co. are engineers and architects for the proposed new Grady Hospital at *Atlanta*, Ga. The original plans call for an expenditure of $5,000,000. . . . A million-dollar plant is to be built for Texlite, Inc., at *Dallas, Tex.* . . . Contract for the construction of the new $7,000,000 building for the Prudential Insurance Co. of America has been let to the William Simpson Construction Co., *Los Angeles, Calif.* The building is designed by architects Walter Wurdeman and Welton Becket. . . . *Hermosa Beach, Calif.*, will vote May 27 on $295,000 in bonds for construction of a municipal pier. . . . Authorizations for construction of a $3,330,000 power station and a $3,000,000 automotive parts plant were approved by the Facilities Review Committee of the Office of the Housing Expediter recently. The power station will be built by Braddock Light & Power Co. at *Alexandria, Va.*, and the automotive plant by Chrysler Motor Parts Corp. at *Detroit, Mich.*

Highways—*Connecticut* will increase its tax on gasoline one cent a gallon to make it four cents. . . . Work has started on a $300,000, four-span reinforced concrete bridge over Sugar Creek near *Yountsville, Ind.* . . . A $3,000,000 grade crossing elimination program is being considered at *Thomasville, N. C.* . . . The *Ohio* highway department plans to spend $40,000,000 this summer in building and maintaining bridges and roads.

Housing—Bridges & Graves Co., *Indianapolis, Ind.*, builders, announced May 1, its plan to complete 8 to 10 houses a month on a 112-dwelling project with a total value of $850,000, one mile east of Garfield Park. . . . Ground has been broken for a 174-house subdivision on Seventh Ave., *Phoenix, Ariz.* . . . A housing project for veterans, consisting of 136 apartment units, will be built in *Rochester, N. Y.*, under sponsorship of the Rochester Home Builders Association, and a $1,250,000 garden apartment building is projected in the same city. . . . Morebilt Homes Corp. plans 100 dwellings and 12 apartment houses at a cost of $1,000,000 for *Atlanta, Ga.* . . . Work has started on 29 houses on North Temple Ave., *Indianapolis, Ind.* . . . A $3,000,000 apartment development at Seattle, Wash., is proposed by contractors Wick & Dahlgren.

Sewers and water supply—*Brookhaven, Miss.*, plans a bond issue to cover the cost of a $500,000 water and sewerage program. It is planned to spend $185,000 for waterworks and $315,000 for sewerage improvements, which include a new $150,000 disposal plant. William E. Mallett and Associates, Jackson, are the engineers. . . . *Gates, N. Y.*, has ordered plans made for a new sanitary sewer system that may develop into a $380,000 project. It has awarded a contract to William S. Lozier Company to make a survey of town needs. . . . The Wisconsin State Board of Health has approved plans for municipal waterworks improvements at *Fond du Lac, Waukesha, Sparta*, and *Williams Bay*.

Tacoma Narrows bridge bids to be asked soon

Bids for both the financing and construction of the new Tacoma Narrows bridge will be called about July 1, Gov. Mon C. Wallgren of Washington announced after a meeting of the Washington Toll Bridge Authority.

The authority adopted a formal resolution authorizing that all necessary steps be taken as rapidly as possible to prepare for the call on bids.

Dean Emeritus Agg dies; long at Iowa state

Dean Emeritus T. R. Agg, 69, of the division of engineering at Iowa State College, Ames, Iowa, died May 7.

On July 1, 1946, Dean Agg retired after 14 years as head of the division of engineering and director of the engineering experiment station at the college. He was born at Fairfield, Iowa, and received his bachelor's degree in electrical engineering at Iowa State College in 1905. In 1914, he received his professional degree in civil engineering at the same institution.

He served as an instructor in the engineering college at the University of Illinois and then as road engineer for the Illinois Highway Commission from 1908 to 1913. In 1923, he became an assistant professor of civil engineering at Iowa State College. In the next 2 years, he was associate and then professor of civil engineering. In 1931, Dean Agg was named assistant dean of the division and in 1932, he became dean and director of the Experiment Station.

A full account of Dean Agg's work in research in highway economics undertaken following his retirement, appeared in the *Engineering News-Record* Nov. 28, 1946, vol. p. 704.

Dean Agg was the author of books on highway engineering, the best known being "The Construction of Roads and Pavements."

Construction volume drops, costs jump

(Continued from page 69)

legislative budgets. The scale granted wages ranging from 85 cents per hour for unskilled labor to $1.71 per hour for operators of shovel-type equipment.

But while these settlements were made, new threats of strikes appeared. In New York City, the Building and Construction Trades Council served notice on contractors of a reopening of the question of wages and hours as of June 30, under terms of a master agreement signed some time ago. In New York's Hudson Valley, and in the Lehigh Valley in Pennsylvania, workers in plants of the Universal Atlas Cement Co. went on strike after expiration of their contracts, despite a company agreement to a 15 cent per hour wage increase, over provisions for work in packaging and shipping cement. An effect of this shutdown was further slowing of work in New York City.

Michigan enters picture

The state of Michigan entered a contractor-union dispute last week with an unusual offer to underwrite a part of increased costs to contractors, if such action would get the men back to work on badly needed school buildings for Wayne University.

Workers struck recently for more pay, and contractors on the jobs informed state authorities that the demands of labor would raise building costs by about 5 percent. They said that demands on the Wayne University structures would boost the original $35,000,000 price by about $1,750,000.

The building committee of the Michigan State Administrative Board—a quasi-legislative body which functions on fiscal matters between and during legislative sessions—agreed to underwrite approximately the amount the contractors testified the costs would be raised in order to get the jobs under way. Testimony was offered to the board that halting work on current construction would be more expensive to the state than meeting the proposed increase.

House bill would permit U. S. loan of technicians to foreign governments

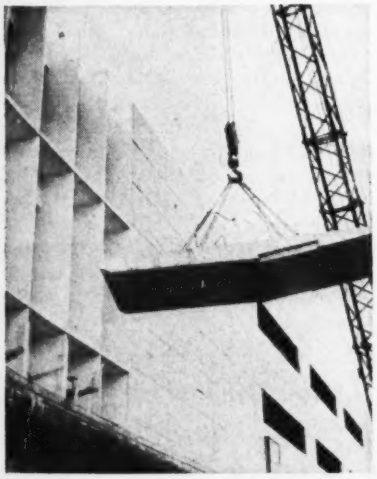
Measure authorizes use of government personnel but prohibits construction—Approved by the ASCE

A bill authorizing U. S. Government agencies to provide engineering services to foreign countries for public works investigations was introduced in the House last week by Rep. Karl E. Mundt of South Dakota.

The measure is a close parallel to the Bloom Bill introduced last year.

Carrying the full endorsement of the State Department, which would have overall supervision as a part of its program of world-wide education in the interests of international good will, the bill (H. R. 3342) is also supported by the Bureau of Reclamation. It permits the use of American personnel to aid public works investigations in foreign countries, but prohibits any construction for those countries, "excepting for the purposes of demonstration."

Other provisions call for the dissemination abroad of "public information about the United States, its people and the principles and objectives of its government."



Store Going Up—*A seven-ton precast concrete slab rises slowly to its place over the entranceway to a new department store under construction at Ft. Lauderdale, Fla., for Burdine's Inc. Designed to carry six stories on its steel frame, the structure is being built to only three stories at present, providing 124,000 sq. ft. of floor space, serviced by two passenger and one passenger-freight elevator and two escalators. Concrete slabs over the main entrance will be framed in aluminum trim and glass block. The Caldwell-Scott Construction Co., Inc., is general contractor, and Abbott, Merkt and Co. are architect-engineers.*

Such a measure was originally opposed by the American Society of Civil Engineers, but the bill in its revised form has been reviewed and approved by the society.

Services permitted

Of particular interest to engineers are sections under Titles II and III of the omnibus measure which providing for the loan of U. S. technical personnel "at the discretion of the Secretary of State"; provisions for education of foreign technical students; and provisions for the "performance by U. S. governmental agencies of such technical services as they may be competent to perform" for foreign nations.

The section (No. 412) authorizing loan of personnel specified that the Secretary (of State) "shall encourage. . . . the performance of . . . services to foreign governments by qualified private American individuals and agencies"; and further declares it to be the sense of Congress that "such services (as may be rendered by government technicians) shall not include the construction . . . or supervision of construction of public works, except as may be accessory to such investigation, instruction or demonstration." The same section also provides that such services shall be rendered foreign nations only when the secretary "shall determine that the national interests demand the rendering of . . . . such services."

The State Department is further enjoined to invite "outstanding leaders both within and outside the federal government" in the various engineering fields, to advise the secretary on policies in rendering engineering services.

Measure supported

In a letter to *Engineering News Record*, Dean Acheson, Assistant Secretary of State, reported that his department had "several times" consulted officers of the ASCE on provisions of the bill, and had prepared a policy statement for inclusion in the bill with their assistance.

"The department believes that the program authorized by the proposed legislation can contribute to the improvement of American foreign relations," Mr. Acheson said.

"It can enable American officials abroad to cultivate closer working relations with other governments; it can bolster American economic policies by helping to train young technicians from other countries and by encouraging the translation of our best technical books; and finally, this program has frequently resulted in the award of contracts to American private firms."

Explaining the Bureau of Reclamation's support, Michael W. Straus, commissioner, pointed out that that bureau is not soliciting foreign work, but that, instead, its assistance is being solicited from all parts of the world. "Our engineers and technicians have pioneered theory and practice in structural designs, construction methods, operation methods and stabilization of agricultural economy. It is not at all strange, then, that the activities of the bureau have been followed closely by countries. . . . where there exists a hope of avoiding strife through stabilization of the agricultural economy," Mr. Straus said.

"The bureau, Mr. Straus continued, "cannot be unconscious of some fear that bureau activities infringe or foreclose non-governmental American industry.

"In my observation, such fear is unwarranted. The Bureau of Reclamation does not, has not, and will not undertake to build foreign water-control projects. Rather by its prestige. . . . it may, and has, inspired other peoples to undertake such works. . . . Rather than bureau foreign activity foreclosing American private enterprise, it has opened to citizens new and promising fields."

ENR EDITOR TO TOUR WESTERN EUROPE

To bring readers of *Engineering News-Record* a first-hand, expert account of engineering developments in the two years since the end of the European war, Waldo G. Bowman, editor-in-chief of *ENR* and *Construction Methods* began a two-month tour of western Europe on May 12.

Traveling on the invitation and with the cooperation of the U. S. Army, Mr. Bowman will revisit much of the territory he covered as a war correspondent during 1944 and 1945.

His itinerary will include the cities of Berlin, Munich, Nuremburg, Stuttgart, Frankfort-am-Main, Dusseldorf, Essen and Minden and the Rhine Valley in Germany, Vienna, Austria, and several cities in France to obtain reports on major hydro-electric developments, and reconstruction programs being carried out by the French government and by private industry.

Appoint W. E. Warne assistant Interior chief

William E. Warne, for the past four years assistant commissioner of the Bureau of Reclamation, last week was named Assistant Secretary of Interior in an order signed by President Truman.

The new appointee succeeds Warner W. Gardner, whose resignation becomes effective June 30.

Mr. Warne, 42, is a native of Indiana, and has long been closely identified with engineering and construction phases of Interior work. After serving on the editorial staff of several California newspapers and the Associated Press, he was assigned to Washington in 1933. He entered federal service early in 1935 as a member of the information staff of the Bureau of Reclamation, and became chief of information for that agency in 1937.

W. E. Warne

His services were loaned to the War Production Board in 1942, and later in that year he became assistant director of Interior's power division, then director of information for the department. He was appointed to the post of assistant commissioner in 1943.

If the appointment is approved by the Senate, Mr. Warne will be the second newspaper man to reach high rank in the Interior department within the last two years. Michael W. Straus, now Commissioner of Reclamation was also a news reporter.

OK simplified practice rule for asphalt tile

A voluntary Simplified Practice Recommendation for asphalt tile has been approved for promulgation, according to an announcement of the Division of Simplified Practice of the National Bureau of Standards. It is effective May 15, 1947, and is identified as R22-57, Asphalt Tile.

The recommendation establishes a simplified list of sizes and colors for asphalt tile and asphalt cove base. Its purpose is to make possible industry-wide production of a simplified but adequate line for all ordinary needs.

The recommendation will be available in printed form, from the office of the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

IT'S STILL BOULDER TO THEM

Five thousand residents of Boulder City, Nev., are sticking by the old name even though nearby Boulder Dam is now officially called Hoover Dam (ENR May 6, vol. p. 778).

The chamber of commerce is steadfastly refusing to change the names on signposts pointing to Boulder Dam.

Name changes in the city itself would serve no useful purpose, Harry Rayner, chamber of commerce president, said.

We intend to call it 'Boulder' Dam, he added, "regardless of the legislation."

N. Y. steel fabricators launch price cut move

Steel fabricators of N. Y. State, meeting in Rochester recently, launched a stabilized price movement that may result in 5 to 10 percent cuts to consumers. The movement hinges upon action of steel mills in removing escalator clauses and quoting "firm" prices.

The association, which represents the 16 steel fabricators in the state adopted this resolution: "That, in keeping with the trend of the times and to stabilize prices to the consumers, the steel mills be asked to give the fabricators firm prices for quarterly periods."

The resolution was sent immediately to the seven large steel producers, Carnegie—Illinois, Bethlehem, Jones & Laughlin, Republic, Phoenix, Luckens and Allen Wood.

Charles B. Spencer named president of The Moles

Charles B. Spencer, vice-president of Spencer, White and Prentis, Inc., last week was elected president of The Moles—New York society of tunnel and heavy construction men.

C. B. Spencer

A 1910 civil engineering graduate of Columbia University, Mr. Spencer served as an ordnance officer in World War I, has been an officer of his present firm during its long career in which it has specialized in underpinning and foundation work.

Other Moles officers elected at an annual dinner meeting, include: J. Rich Steers, Jr., first vice-president; and Carlton S. Proctor, vice-president.

Gen. T. F. Farrell to head N. Y. City housing body

Maj. Gen. Thomas F. Farrell, chief engineer of the New York State Department of Public Works and a veteran of both world wars, will become the new chairman of the New York City Housing Authority, July 1.

Gen. Farrell

In announcing the appointment Mayor William O'Dwyer said that it foreshadows a speed-up of the authority's work and closer relations on housing between the city and the state. Gen. Farrell, who will be the authority's first paid chairman, succeeds Edmond B. Butler.

General Farrell, 55, was graduated from Rensselaer Polytechnic Institute in 1912 as a civil engineer. During the first world war he served with the First Engineers, and later taught engineering for a time at the U. S. Military Academy. In 1926 he was appointed commissioner of canals and waterways for New York State, and became chief engineer of the Public Works Department four years later. Recalled to active Army duty in 1941, he became chief of the construction division in the office of the Chief of Engineers of the Army, in charge of all War Department construction in this country.

In 1943 he became chief engineer for the China-Burma-India theater and was promoted to brigadier general when he became assistant to Maj. Gen. Leslie Groves on the development of the Atomic bomb. He became a major general in 1945, and returned to duty with New York State in January of last year.

Utah Oil Refining Co. to build new pipeline

To meet increasing demand for all petroleum products in Utah, the Utah Oil Refining Co. has announced plans to build a direct pipeline from Rangely, Colo., to Salt Lake City.

At present the company has a 10-in. line from the big Rangely field to Wamsutter, Wyo., with a capacity of 25,500 barrels daily. At Wamsutter, this line connects with other Utah lines and is now delivering 22,000 barrels of crude oil daily to Salt Lake City.

The new line also will be constructed of 10-in. pipe and will be equipped with pumping capacity sufficient to deliver 24,500 barrels daily.

U.S.-Mexico sanitary engineers foster joint action on border sewage works

Meeting of public health workers in the Southwest promotes closer relations with Mexico on border sanitation measures.

By C. G. Gillespie

Surveys for an international sewage disposal project now under way are a tangible result of closer cooperation between the United States and Mexico in the promotion of border sanitation measures, delegates to the 5th annual meeting of the U. S.-Mexico Public Health Association in San Diego, Calif. May 6-8 were told.

The meeting provided the opportunity for sanitary engineers of the Southwest to strengthen relations with their colleagues in Mexico for joint action on problems of mutual interest. Not the least of these actions is the formulation of joint sewage disposal projects for Mexicali, Mexico, and Calexico, Calif., as well as at Tia Juana. In both instances sewage flows across the border into the United States.

The situation at Mexicali was outlined by R. F. Porton, sanitary engineer, U. S. Public Health Service, who pointed out that sewage-polluted water from Mexicali flows into California by way of the New River, past the town of Calexico, which also discharges its sewers into the same river. Mexicali has a population of about 40,000 and industrial waste equivalent to 16,800 population; Calexico's population is 6,000.

There is no space for a disposal works in Mexicali, and the logical location is below Calexico. Surveys have been authorized by the U. S. State Department and the Mexican government, and these are now being made by the international boundary and water commission that serves the two countries.

Irrigation with sewage

In a symposium on the development of irrigation water standards, it was pointed out that all the Southwest is arid, and sewage effluents therefore will be in greater demand for irrigation applications. But this cannot be realized until proper standards that guard against spread of disease, even including diseases to animals—like beef tapeworm—in which the activities of man play a role in the chain of transmission, as well as chemical qualities, are established. The orthodox coliform test is useless for irrigation waters, which contain a high content of animal manures and soil. Hence a new index organism must be found.

Results from an international common-carrier watering-point survey for the railroads of Mexico were outlined by Jesus Diaz Barriga, chief of the Mexican water division. From a study of 18 places deriving water from various sources, only 5 were found to be safe. The need for training waterworks and watering point personnel was stressed.

Sanitation progress

An outline of sanitation progress in the Southwest was given by Ray F. Goudey, sanitary engineer of the Los Angeles Water Department, who pointed out that typhoid rates in the Arizona-Southern California area have dropped from 44.7 to 3.5 per 100,000 population in the period 1917 to 1943. Investment for waterworks and sewage systems aggregates $5 billion, or $1,000 per person in this area.

The high sodium content of waters in the Southwest led Mr. Goudey to speak a word of caution because of the increase of sodium by some methods of water softening with consequent damage to soils. He indicated that softening had better be confined to home use on hot water systems, and advocated the substitution of the newer detergents for soaps now in the household.

The sanitation research program of the National Institute of Health, which provides federal funds for projects carried out by colleges, organizations and individuals, was discussed by Ernest M. Allen, assistant chief, U. S. Public Health service, by V. M. Ehlers, state sanitary engineer of Texas, and C. G. Gillespie, former state sanitary engineer of California. Some $3 million have been allocated for 294 grants made to 84 institutions; 76 other projects have been approved for funds, and 151 are awaiting consideration.

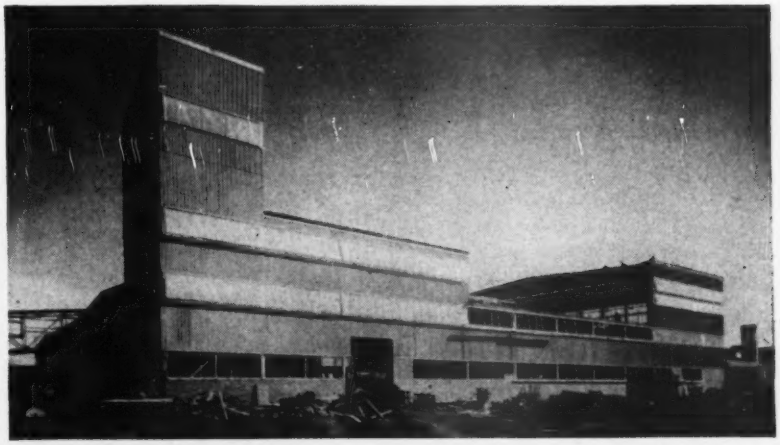
Other papers at the conference dealt with San Diego's new water supply, California stream pollution legislation, sanitary engineering in Latin America, and mosquito control.

Dr. James R. Scott, state health officer of New Mexico, was elected president, succeeding Dr. Gustavo Rovirosa of Mexico. The next meeting of the group will be held at Laredo, Tex.

Sanitary engineer group opens membership drive

Invitations for affiliation with the recently organized Inter-American Association of Sanitary Engineering are being issued by the United States representative of the membership committee, Homer J. Hayward. The association, which was organized last year following conferences in Rio de Janerio, Brazil, and Caracas, Venezuela (*ENR* July 4, 1946 vol. p. 4, and Oct 10, 1946, vol. p. 471).

Membership charges are $3. Applications should be addressed to Mr. Hayward, at the association's headquarters, 17th and Constitution Aves., Washington 6, D. C.



***Iowa Tractor Plant**—Now in partial production at Dubuque, Iowa, turning out John Deere farm units, this $6,000,000 plant is scheduled for completion by July. Buildings inclosing 500,000 sq. ft. of floor area are laid out on 700-acre site to allow flexibility in expansion of various departments; space is available for growth of plant to five times its present size. Foundry group, shown here in part, employs corrugated asbestos cement for roofs and for closures wall, between alternate bands of corrugated glass. Day and Zimmerman, Phialdelphia, are engineers and contractors.*

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

New Orleans approves $23-million bond issue for streets, railroad program—Urge city-owned parking lots for New York—Atlanta pushes new fire code enforcement—Seek new tunnel crossings under river at Portland, Ore.—Other city news

Backed by a taxpayer vote favoring a $23,500,000 bond issue to finance the work, officials of New Orleans, La., are pushing negotiations to get a 3-phase civic improvement project started.

The overall plan—which would provide a new Union Terminal, grade-crossing elimination, a new civic center and extensive street paving—will involve the expenditure of more than $40,000,000.

The new terminal and grade elimination portion will call for spending about $29,000,000, of which the city will pay less than half, and the railroads involved the balance, excepting for $2,200,000 to be contributed by the state highway department.

Of the bond issue, $10,500,000 will go to pay for a citywide street paving program; $1,000,000 for a site for a new civic center. City engineer's office supervised the initial plans.

While New Orleans prepared to work on its program, several other cities reported extensive street-paving plans. Among these were Baltimore, Md., where a $3,141,900 program for renovation of the Light Street waterfront was recommended by the city council; and Atlanta, Ga., were contracts were let for 21 street paving jobs.

Seek traffic tunnel

Portland, Ore., civic organizations last week launched a campaign for construction of a multi-lane tunnel under the Willamette River, which flows from south to north through the city.

Traffic between the two sectors of the city is at present accommodated by eight bridges—two of them crossing a ship channel, and only one with sufficient clearance to obviate the use of drawbridges. Traffic jams on the bridges, mostly caused by frequent opening of the draw spans, are said to be responsible for numerous accidents, and cost millions annually in lost time.

Atlanta pushes fire code

In an effort to make all public buildings safe from such a disastrous fire as that at the Hotel Winecoff some months ago, Atlanta, Ga., city officials said last week that inspections had been completed in all hotels and many other structures.

The inspections were made in the light of new fire code provisions that require all hotels, rooming houses, hospitals, theaters and other public buildings to obtain "certificates of occupancy", issued after compliance with broad provisions of a new state law and city codes providing precautionary measures against fire.

To date, the city council has ordered issuance of certificates to two hotels as a result of the inspections, and has cited the owners of several other structures for non-compliance.

New York's parking

While New York City councilmen last week debated licensing and regulation of privately-owned downtown parking areas, the city's Traffic Committee urged that the city establish off-street parking facilities under direct city operation.

Under the plan recommended by the committee, the city would acquire the needed space by condemnation or lease, clear the sites and use them for parking. Police Commissioner A. W. Wallander, who is chairman of the committee, urged speedy action to relieve the city's growing traffic problems.

Meanwhile, at Richmond, Va., where a local newspaper had called in its own experts to investigate the feasibility of plans for throughways cutting across the city (*ENR* April 17, vol. p. 562) the investigation was extended to the consideration of possible sites for parking facilities. Investigators, pointing out that construction of the new highways would bring added traffic into the business area, said provision of more adequate parking facilities would be "imperative," if the improvement is to unsnarl traffic congestion.

Detroit port development

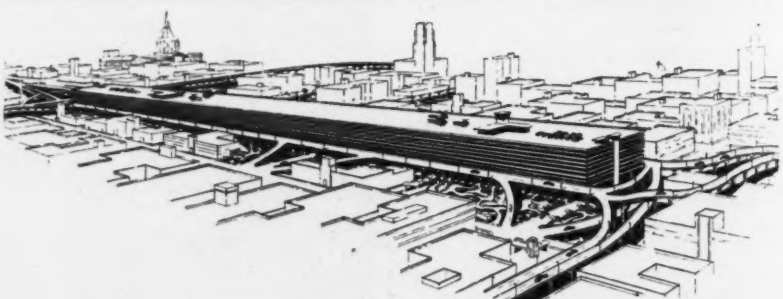
Pointing out that Detroit's port district has no public wharf capable of handling a large amount of traffic, the Port of Detroit Commission recently submitted a waterfront development program to Governor Sigler of Michigan and the Wayne County Board of Supervisors.

The plans call for a new entrance to the port; installation of two additional landing facilities, and two small boat harbors to service an estimated 3,500 small pleasure craft berthed in the area. Other proposals include creation of a bulk freight terminal, and two terminals to provide for direct transfer of lake-borne freight to trunk-line railroads or trucks.

Sewage treatment plants

Many cities during the week reported advancing their plans for sewage treatment works and disposal systems.

Among these were: Knoxville, Tenn., where city officials began consideration of a new site for a disposal plant, after the University of Tennessee turned down the city's offer to purchase an existing plant at the college's agricultural farm; Enumclaw and Olympia, Wash., where bids were being received for construction of disposal plants and sewer lines; and Gosport, Elkhart, Alexandria, Mishawaka and Goshen, among many cities in Indiana.



***Novel Parking Idea**—A plan for a $33,000,000 garage, nearly a mile long, nine stories high and 145 ft. wide, has been approved by the planning committee of San Francisco's Board of Supervisors, as a solution for the city's traffic troubles. The 4,455-ft. long structure would contain some 5,168,000 sq. ft. of parking space, and would provide a helicopter landing field on top and store space at the ground level. Ramps would connect the structure to surrounding streets and parkways.*

Seek uniform standards for airport runways

National adoption of standard limits for runway lengths and gross airplane loads is a definite possibility in the near future, according to four aviation authorities who spoke at a dinner meeting of the Illinois Section, ASCE, in Chicago May 5. For major airports, a gross load of 200,000 lb. and a runway length of 7,000 ft. at sea level have been proposed, and good prospects exist that limits approximating these suggested criteria will be established, the meeting was told.

As a result of a request from Chicago for consideration and adoption of uniform runway standards, T. P. Wright, Administrator for Civil Aeronautics (head of CAA), has addressed a letter to the airplane manufacturers asking their views on the proposed 7,000-ft., 200,000-lb. limits. These standards would be ample to take care of any aircraft contemplated for the future by the United Air Lines, according to John Newey, vice president, who spoke at the meeting.

Participants in the four-man panel, in addition to Mr. Newey, included Ralph H. Burke, airport consultant for the City of Chicago; Lane W. Wilcox, regional superintendent of the airport branch, CAA, and Robert Dewey, director of aeronautics for the State of Illinois.

Development of aviation now has reached a stage which makes advisable the adoption of standards for airports to prevent these facilities from becoming obsolete, the panel members agreed. They pointed to the experience of railroads and highways as comparable to the action now required for airports.

Two plans for Chicago Orchard Airport (Douglas Airport) the city's proposed major facility, are at present in the hands of CAA in Washington for study and determination of the final, approved design. As now drawn, each calls for twelve tangential runways, with a runway length of 6,000 ft. in one plan and 8,000 ft. in the other. If a standard of 7,000 ft. at sea level should be established, the runways required at Chicago would be about 7,135 ft. in length.

Construction of the new airport is scheduled to start within two years and to be completed within five.

To take care of traffic expected by 1960, plans for the new airport contemplate 360 plane movements per hour, requiring simultaneous use of six runways (at 1-min. spacing of planes) and berthing space for 90 ships. Studies are being made to determine whether a total of ten runways would be sufficient for the airport.

House group slashes CAA's construction fund

The request of the Civil Aeronautics Administration for $65,000,000 in fiscal 1948 for the construction of Class 4 and larger airfields was cut by fifty percent by the House appropriations committee this week in reporting out the appropriations bill for the departments of Commerce and State.

In taking this action, the committee stated that most of the $45,000,000 appropriation for work during the 1947 fiscal year, (which ends June 30), still remains to be spent and that this money, combined with a new appropriation of $32,500,000, would be sufficient to make a major start on the $1,000,000,000 airport construction program approved by Congress in May last year (*ENR* May 16, 1947, vol. p. 763).

Approve first project

The first project approval under the Federal Airport Act has been signed by T. P. Wright, Administrator of Civil Aeronautics, opening the construction phase of the 7-year airport building program.

It will permit Twin Falls, Idaho, to start work immediately on a new Class III airport, so that the rich irrigated area of Southern Idaho can be served by the United Airlines transcontinental route, by Empire Air Lines feeder service, and by non-scheduled cargo and passenger operators.

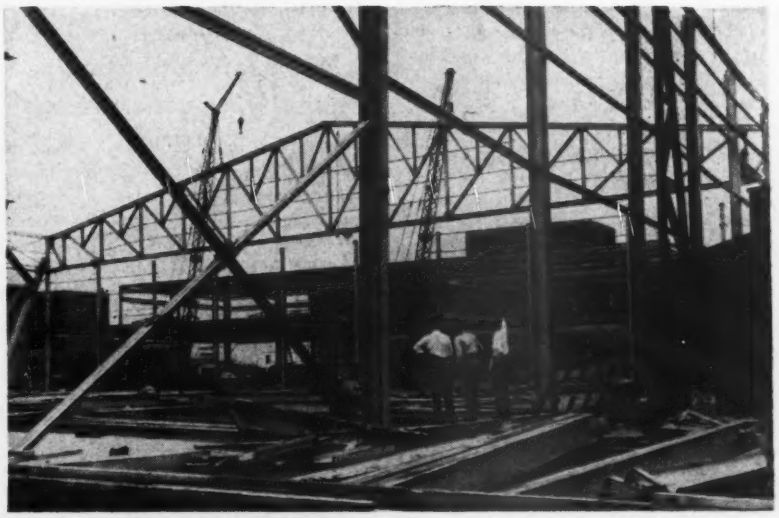
This project will cost $647,221, of which the federal share is $384,000. The sponsor's share of $263,221 was raised by a local bond issue and airport tax levy. The money will be used for land acquisition, drainage, seeding, paving of taxi-ways, aprons, parking area, and access roads, and for construction of paved runways 4,900 and 3,200 ft. long. Ultimate plans call for extending the runways to 6,500 and 4,900 ft., lighting the field, and erecting an administration building.

Army builds supersonic wind tunnel at Caltech

An expenditure of $2,384,000 has been authorized for Army construction of a new-type supersonic wind tunnel for testing burning ram-jet and other type rocket motors at the California Institute of Technology.

An Army announcement last week said that since no other wind tunnel in the U. S. is designed to test missiles with motors operating, the Los Angeles, Calif., district engineers office will call in scientists of the institute and experts from the Air Forces, the Ordnance Department and the Navy to consult on the design.

Located in a special building 50 by 150 ft. in size, the testing section of the tunnel will consist of a flexible nozzle with a cross section 15 by 20 in. Three air compressors capable of producing a combined total of 171,000 cu.ft. of air per minute will develop a testing velocity in the tunnel of 3,600 mph.



***Atlanta Hangar Construction**—One of the largest steel trusses ever erected for a commercial airline hangar in the south goes up on a new structure for Delta Air Lines in Atlanta, Ga., as a part of a $1,000,000 expansion program at the city's airport. Seven similar trusses, each of 190-ft. span, will carry the roof of the 155-ft. long structure. Trusses were designed by The Austin Co., which is erecting the building.*

Blame poor construction as fire cause

Failure of the construction industry to construct better buildings is a major factor in the country's large annual fire loss, the nation's first fire prevention conference was told last week at a meeting in Washington, D. C.

"It has been well said that fire safety begins in the designer's office," a special committee report said. "This observation may well be expanded to state that unless adequate fire safety is established there, it will never be fully obtained. The cost of installing safety features, although relatively minor at the time of construction, may be so prohibitive thereafter as to permit only partial compliance with generally accepted standards."

The 3-day conference was called by President Truman, who appered briefly before the more than 2,000 who attended. Maj. Gen. Philip B. Fleming, Federal Works Agency Administrator, served as chairman of the sessions, opening the meeting with the statement that in 1946 more than 10,000 persons lost their lives by fire and more than $560,000,000 worth of property was destroyed.

Over 50 percent of this huge loss was outstandingly the result of inferior building construction, the special committee set up to report on construction operation and protection, told the conference in a strongly-worded report.

"Only six large-loss fires occurred in fire-resistive buildings," the report said. "In 81 fires the fire areas were excessive, and unprotected stair wells, vertical openings and elevators were important factors in the spread of 71 fires studied for the report.

"Building practice is now so advanced a science that there is little excuse for erecting buildings that are deficient in any safety precautions. Structural design has progressed to the point where the safety of the building from the strength standpoint is taken for granted by the occupant. He has an equal right to assume that fire hazards in his building have been eliminated or controlled."

Designers and construction engineers were also called upon to provide greater assistance in bringing building codes up to date, in enforcing those codes, and in seeing that buildings are utilized in a manner that will not produce grave fire hazards.

Wood preservers study new methods

Members of the American Wood Preservers Association, meeting in Portland, Ore., recently, were warned against departure from time-proved methods of wood treatment.

The service bureau board of the association urged that the industry—while encouraging the development of new preservatives—give careful consideration to their merits, based on satisfactory performance over a reasonable period of time, before placing them on a par with present materials.

At the same time members were told that in some products improvement in treating methods must be developed to meet changing conditions, especially in the treatment of railroad crossties, the industry's biggest asset. Higher train speed and heavier equipment have materially reduced the service life of ties.

Solution of the crosstie problem is not yet at hand, but extensive research is under way, speakers said. It has long been maintained that nothing could ever take the place of wood in railroad ties, but recent developments have caused the wood producing and wood treating industries to realize that substitutes are not impossible. Experiments with ties of concrete and other materials already have been made.

Officers elected include A. J. Loom, general superintendent of timber preservation, Northern Pacific Railroad, Brainerd, Minn., president.

Minnesota passes bill specifying concrete mix

In a last minute action before its recent adjournment, the Minnesota legislature revived and passed a measure requiring the state highway department to specify the use of 15 percent of natural cement in all highway concrete.

Opposed by the Northwestern Section of the ASCE, the measure appeared to have been killed in committee some weeks ago (*ENR* April 24, vol. p. 717). However it was brought out of the committee and passed as the session ended with a few votes to spare. As passed, the measure will be effective only until January 1, 1948, after which the restriction is to be lifted.

The ASCE section opposed the measure on the ground that mix design should be left to the judgment of engineers and not made mandatory. No criticism was made of the use of natural cement.

PRA outlines policy on construction costs

In a move to keep roadbuilding costs from going higher than the 1946 level—and to bring them below that level if possible—district engineers of the Public Roads Administration recently were instructed to continue to urge state highway departments to select only essential projects, and to go ahead with work on which there is "free and real" competition by interested contractors.

Study of the 1946 bid prices and present trends has convinced PRA that there will be sufficient profit for contractors in the general price level is kept below that of last year. Regional PRA offices have been instructed that 1946 price levels established in the various sates should be used as the base for comparison.

Engineers' field limited by Quebec appeals court

Activities of civil engineers in the architectural field in the Province of Quebec have been sharply restricted by a decision of the provincial court of appeals in a case carried to that court by the Architects Association of the Province of Quebec. The association brought action against B. H. Terry, a civil engineer, for violating the architects' practice act in designing an addition to the plant of the Harrington Tool & Die Co. at Lachine, Que., and supervising the construction of that plant without a license to practice as an architect in the province.

In rendering the court's decision, Justice Mackinnon said. "It is impossible to lay down any definite rule which would adequately define the respective monopolies of architects and civil engineers. It is conceded that when a building is an accessory to the work of a civil engineer, as defined by the civil engineers' act, it comes within the rights and duties of the civil engineer, but when, as in this case, it was clearly demonstrated that the Harrington building, with its problems and particular requirements, was one which a fully qualified architect is capable of designing, it is not an engineer's work."

Pennsylvania snow bill $7 million last winter

Snow removal cost on more than 20,000 miles of Pennsylvania highways during 1946-47 season ran between $6,000,000 and $7,000,000, Ray F. Smock, highway secretary, said recently.

OBITUARY

George Alfred Maney, 58, professor of structural engineering at Northwestern University since 1928, died in Evanston, Ill., May 10. He received his degree in civil engineering from the University of Minnesota in 1911. Professor Maney was credited with making the first general statements of engineering principles on the slope deflection method, secondary stresses in steel bridges and, in collaboration, on statically indeterminate stresses.

Walter P. Johns, 69, retired city engineer of Wilkes-Barre, Pa., died in Bloomsburg, Pa., May 10. He served Wilkes-Barre for 31 years.

Jay Lloyd Frazier, 53, highway contractor, died in Oklahoma City, Okla., April 29. He was a former county engineer of Pittsburg, Pottawatomie, and Oklahoma counties. Later he established the Frazier Construction and Materials Co.

Winfred J. Werle, 48, retired civil engineer, died in Milwaukee, Wis., April 28. He was formerly an engineer for the Milwaukee County sewerage commission.

M. Z. Bair, sanitary engineer and former chief engineer for the Arkansas state board of health, died at Booneville, Ark., May 1. A graduate of Cornell University, at one time he was principal assistant engineer of the Ohio State Department of Health.

John A. Goetz, 61, superintendent of the sewer and water department and former city engineer of Mattoon, Ill., died April 26. Under his management the city water system of Mattoon was converted from the fusion of a private clear water and a public industrial (raw surface water) system into a well coordinated utility.

Peter W. McDonald, 70, a civil engineering graduate of McGill University died at Stanley, N. S., April 27. He had been consulting engineer at Montreal, Que., and Halifax, N. S., and in the war was assigned to engineering work on the airport at Stanley.

John W. Beatty, 101, a contractor for more than 60 years, died April 15 at Mannhurst, N. B.

Joseph Leo McPoland, 69, for 50 years a leading contractor in Birmingham, Ala., died May 1. Mr. McPoland had been associated with the contracting firm of Sullivan-Long & Hagerty for the last 35 years.

Harold C. Stephens, 63, a design engineer for the last 40 years for the Kroehler Manufacturing Co., Naperville, Ill., died April 30.

William Elmer, 77, special engineer in the chief engineer's office of the Pennsylvania Railroad and former superintendent of the Pennsylvania division of that railroad, died at Rockledge, Fla., May 6. He was a graduate of Princeton University, 1894.

Arthur J. Widmer, 64, president of the Widmer Engineering Co., died at St. Louis, Mo., April 30. He was colonel of Army Engineers on the reserve list. During the war he was engineer on construction projects for the Army.

Philip C. Nash, 56, formerly assistant engineer for the Boston, Mass., Transit Commission and head of the civil engineering department at Northeastern University, Boston, and since 1933 president of the University of Toledo, Ohio, died in the latter city, May 6. He received his master of civil engineering degree from Harvard University.

George C. Love, 62, Durham, N. C., civil engineer, died May 5. A graduate of North Carolina State College, he had engaged in railroad construction work in Mexico and Haiti, and for many years was connected with the North Carolina Highway and Public Works Department. He also helped build the athletic stadiums at Duke University and the University of North Carolina.

MAJOR MEETINGS

Society for Experimental Stress Analysis, annual meeting, Stevens Hotel, Chicago, Ill., May 15-17.

Associated General Contractors, spring meetings, governing and advisory boards, Olympic Hotel, Seattle, Wash., May 19-21.

American Shore and Beach Preservation Association, 21st annual meeting, The Berkeley Carteret, Asbury Park, N. J., May 27-28.

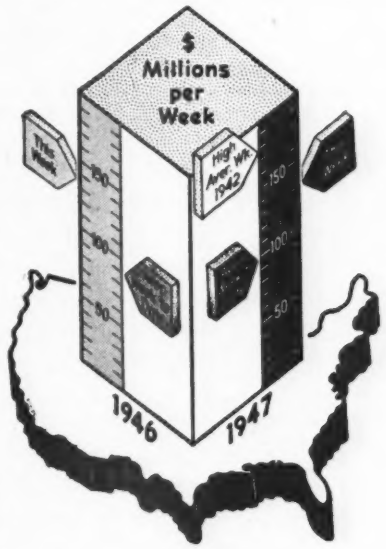
American Society for Testing Materials, 50th annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-20.

American Society of Engineering Education, annual meeting, University of Minnesota, Minneapolis, Minn., June 17-21.

American Water Works Association, 67th annual conference, jointly with Federation of Sewage Works Association, 20th annual meeting, Civic Auditorium, San Francisco, Calif., July 21-25.

Federation of Sewage Works Associations, jointly with American Water Works Association. See above.

CONSTRUCTION ACTIVITY



As Reported this week to ...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of May 15 1947	Cumulative 1947 (20 wks.)	Cumulative 1946 (20 wks.)
Federal	$ 6,425	$191,705	$236,446
State & Mun.	32,662	582,723	435,348
Total Public.	$39,087	$774,428	$671,794
Total Private	92,226	1,196,872	1,228,905
U. S. Total	$131,313	$1,971,300	$1,900,699

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (20 wks.)	Cumulative 1946 (20 wks.)
Waterworks	$ 715	$46,775	$39,354
Sewerage	3,951	41,948	24,180
Bridges	2,423	59,629	44,774
Highways	18,903	259,486	246,892
Earthwork, Waterways	3,884	101,911	145,167
Buildings, Public	5,398	187,125	109,634
Industrial	19,798	311,747	379,708
Commercial	38,290	696,582	772,920
Unclassified	37,946	266,097	138,070

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (20 wks.)	Cumulative 1946 (20 wks.)
NON-FEDERAL	$618,481	$367,154
Corporate Securities	212,654	150,922
State and Municipal	405,827	216,232
FEDERAL		158,320
Total Capital	$618,481	$525,474

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	May '47	396.49	190.59
Building Cost	May '47	299.61	161.96
Volume	Apr. '47	247	108

EDITORIALS

VOLUME 138 NUMBER 20

May 15, 1947

Thomas R. Agg

THROUGH THE DEATH of Thomas R. Agg, dean emeritus of the engineering school at Iowa State College, the engineering profession lost one of its leaders whose breadth of interest, sound judgment and fearlessness were an inspiration to all who knew him. His going will be most deeply felt in the field of highway engineering, to which he devoted so much of his active life. He started his teaching career with a background of five years of hard practical work in the Illinois highway department and he never lost contact with the practical side of road building. This is reflected in much of the research that was carried on during the past 20 years under his direction in the Engineering Experiment Station at Ames. But he found time for many activities far outside the realm of highway engineering. He was an authority on valuation, took an active part in the American Society of Civil Engineers, the Iowa Engineering Society and the Ames Chamber of Commerce. When trade unions started a drive to organize engineers in Iowa, Dean Agg helped to organize an aggressive counter offensive that was highly successful. Those who look for individuals who can be cited to the coming generations as examples of well-rounded engineers should put Thomas R. Agg among the top men on their list.

Hoover Dam

THERE CAN BE NO QUESTION henceforth that the name of the great dam on the Colorado is officially Hoover Dam. A Republican Congress has passed an act to that effect and a Democratic President has signed it. Brought into being by the Boulder Canyon Act, the dam was built in Black Canyon. Initially known as Boulder Dam, the name of Hoover was first applied at the ground-breaking ceremony, Sept. 17, 1930. A joint resolution, introduced in Congress to make the name official, was never acted upon, but Hoover Dam it was called nevertheless. With the advent of the Roosevelt administration, Interior Secretary Ickes used his official prerogative to declare the name to be Boulder Dam. In retrospect, no action could have been more certain to cause a reaction. It has been 15 years in coming, but Hoover Dam it officially is today. Without question there is logic and fitness in applying Mr. Hoover's name to the dam. While Secretary of Commerce he was personally active in bringing about the seven-state compact upon which the Boulder Canyon project rests, and as President he supported and signed the act that brought the project into being. In general, our own preference is for engineering structures to retain their geographic names—Brooklyn and Golden Gate bridges, Shasta and Grand Coulee dams, for example—because they are more informing and usually more euphonious. But if a person's name must be used, it should at least be appropriate and deserved. Mr. Hoover's name meets that test.

A Jurisdictional Dispute

ACROSS THE BORDER in Quebec, architects have dragged a civil engineer into court in a jurisdictional dispute that should cause all reputable architects in the province to blush with shame as the court action was inaugurated and carried up to the provincial court of appeals by the Architects Association of the Province of Quebec. The civil engineer concerned had designed and supervised construction of an extension to the plant of the Harrington Tool and Die Co. at Lachine, Que. No question of his competence to design a safe structure was involved; the court action was obviously an effort to use the wording of the architects' registration act as a means for curtailing the building design work done by registered civil engineers, thus cutting down their competition with architects in that field. About 15 years ago, a small group of architects in New York State started a similar action with the same objective, but when it was brought to the attention of the top men in the American Institute of Architects they stopped the movement. It is too late now for similar action in Quebec, but the leading architects of that province can nullify the effect of the appeals court decision by seeing to it that the decision is never used to keep engineers from designing buildings.

To Help You Look Ahead

NO PHASE of engineering and construction endeavor can be planned without some appraisal of future economic and social developments. The scope, anticipated period of usefulness and the

financial return from a structure or project must be analyzed in terms of tomorrow's conditions as well as today's needs. Any means, therefore, that will assist in forecasting what the future may hold in terms of population trends, worker productivity and employment, changes in living standards, and technological progress, form an essential part of basic engineering data. This is one of the reasons for a special report in this issue on "USA—1950-60", which outlines the findings made by the Twentieth Century Fund.

Limitations on Landfill Site Use

WHAT are the potentialities of a refuse landfill as a site for building purposes? Experiences at a temporary housing project in New York City provide a conclusive—although not unexpected—answer, which is: Avoid any use of a landfill containing mixed garbage and rubbish that involves exposure of the buried material.

Hard-pressed for a large site on which to erect several hundred temporary homes for veterans' housing, the city authorities selected a 130-acre area that was awaiting conversion into a park. Six years ago this area was a swamp into which more than a million yards of refuse was deposited to raise the grade some 15 feet to the level of surrounding streets. As described in the May 1 issue (vol. p. 756), use of this area for a housing project called for regrading and installation of utilities, all of which involved considerable excavation. This unintended exposure of decomposing garbage caused such a stench that men refused to work in the trenches and complaints originated from residents surrounding the area.

Probably never before was there a more intensive search begun for odor-control measures. Chemical manufacturers, health department inspectors, sanitary engineers and university research consultants applied their special talents to combat "The Great Stink". After numerous trials, someone suggested that the liquid spray used on the streets around the Fulton Fish Market—a proprietary oxidizing agent—might be effective. Powerful stuff, it did the job. And house-building continued under less redolent conditions.

More important, perhaps, than odor control at the site was the necessity for coping with gaseous products of decomposition. Because a high percentage of methane (about 56 percent in fills four years old) is generated, there is the possibility that an explosive condition might occur in a closed space. This was demonstrated accidentally a few years ago when a workman's shanty on a fill blew apart after a match had been ignited inside. As a consequence, the houses have been constructed with a vented air space beneath them and the floors are sealed with an aluminum foil membrane.

Problems such as these should provide ample discouragement to those who contemplate the use of landfill sites for purposes other than parks, athletic fields or parking areas. And when a fill of this type is made, it would also be well to determine in advance what the ultimate use will be; thus later topographic changes—with attendant exposure of decomposing material—can be avoided.

Loads on Airport Runways

THE MOVEMENT started recently in Chicago to fix an upper limit for loads on airport runways as well as for runway lengths should do much to insure that airports built today will not be made obsolete by tomorrow's airplanes. As reported in the news pages of this issue, the Administrator for Civil Aeronautics has asked airplane manufacturers for their views on a proposal to set the gross load limit for runways at major airports at 200,000 lb. and the maximum runway length at 7,000 ft. at sea level. Acceptance of these or similar limits by the manufacturers should put an end to the present uncertainty as to what capacities are to be required in the near future. And, presumably, lower standards will be set for airfields in lower classifications.

Many years ago, the railroads found that similar load and clearance limits were necessary, and since the advent of motor trucks, the state highway departments have had to set wheel-load limits to protect their road surfaces against destruction by loads above their safe capacity. The CAA already has done much toward standardization of airports for various sizes of communities in order to protect the investment and to make wasteful overdesign of runways unnecessary. This latest effort to obtain agreement on standards for the larger airports should be very fruitful because the cost of building such fields has skyrocketed in recent years.

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WALDO G. BOWMAN, *Editor*, EDWARD J. CLEARY, *Executive Editor*
New York: V. T. BOUGHTON, R. K. TOMLIN, H. W. HUNT, E. E. HALMOS, JR., T. D. MacGREGOR, JOHN C. BUMSTEAD and F. S. MERRITT
Chicago: V. B. SMITH, *Cleveland:* J. R. CARR, *Washington:* A. N. CARTER, *San Francisco:* N. A. BOWERS, L. L. WISE
EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

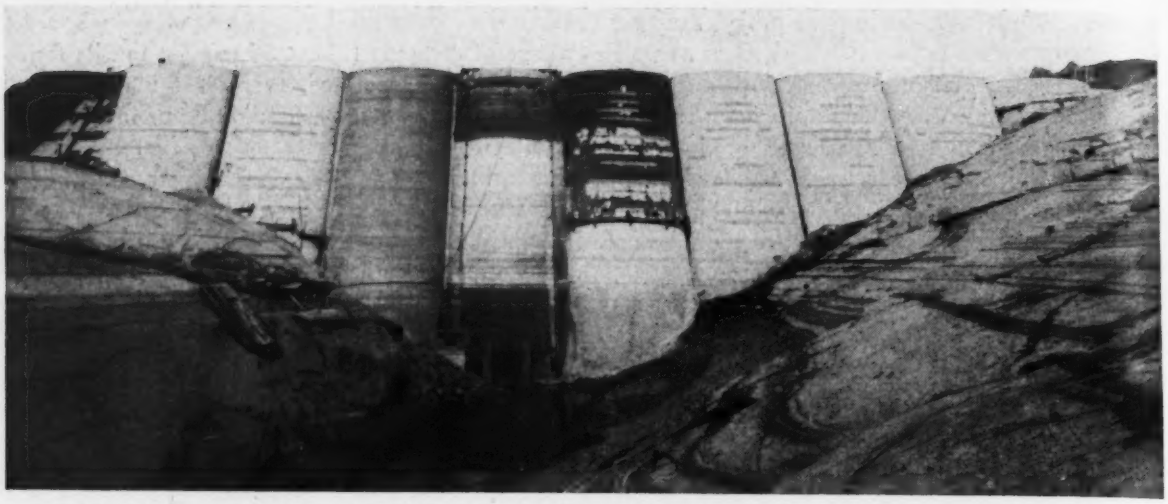


Fig. 1. Florence Lake Dam is made up of 58 arches; this is the highest portion. Men on scaffold give scale.

Asbestos-Felt Blanket Protects Thin Concrete Dam from Frost

***Contents in Brief**—Surfaces of multiple arches of Florence Lake Dam in southern California after 20 years of severe exposure at El. 7,300 have been coated with an asbestos-felt application, selected as the best of many tested, which is expected to keep the concrete surfaces dry and hence to prevent frost damage to the structure in the future.*

WHEN the multiple arch type of dam was selected by the Southern California Edison Co. in 1924 for developing storage in Florence Lake at El. 7,300 on the upper San Joaquin River, it was known from experience with other concrete structures at high elevation that exposure would be severe. A plan of operation was, therefore, developed to keep the reservoir level low during the winter so as to eliminate ice damage and minimize frost damage as much as possible. Although reasonably successful, since frost damage was limited to relatively shallow depths in the surface of the arch extrados, some supplemental protection has in recent years been deemed desirable. After extensive experimentation the decision favored covering the upstream face with an asbestos-felt blanket or membrane and two applications of an asbestos cement. This latest protection is now in service.

Florence Lake Dam consists of 58 arches spanning a granite gorge at the upper end of a chain of hydroelectric plants. The arches have a uniform span of 50 ft. but vary in height to a maximum of about 140 ft. The thickness of the arch barrel varies from 18 in. at the top to 4½ ft. at the base of the highest arch. The upstream face of the dam, at the base, has an earthfill against it up to El. 7,235. The crest of the dam is at El. 7,329, thus making the maximum height of exposed concrete, measured vertically, 94 ft.

Waterproofing paints tested

Shortly after construction of the dam, a waterproofing paint was applied to the upstream surface as a protective coating. When this was found to be inadequate various other expedients designed to give frost protection for concrete at very high altitudes were tried. In fact, study of this little-known subject has continued for some 20 years. More than 60 different preparations, commercially offered for such waterproofing, have been tested at the company's laboratory, and the best were applied to areas of several square yards on the dam for exposure through a winter. Some of the compounds had coal-tar bases, others contained asphalt, paraffin or even a cement emulsion. Some of these were applied over cracks in the concrete to see whether the material would span well. Some preparations went to pieces during the first winter's exposure and some lasted two winters or more.

Some that showed up well in laboratory tests blistered in the field tests as the result of gas formed beneath the coating. A 2-in. layer of shotcrete on mesh reinforcing had adequate strength but fine cracks developed over underlying horizontal joints and elsewhere in the shotcrete, and the coating lost much of its effectiveness. One experiment involved a welded 12 ga. steel facing on the upstream side of one arch, and while this showed promise it could not be generally used because of shortage of steel during the war years.

The most satisfactory treatment and the one finally chosen for use over the entire upstream area of the dam (a total of some 256,000 sq.ft.) is a composite of several layers including a membrane of 15-lb. asphalt-saturated asbestos felt and two applications of a plastic asbestos cement. The greatest disadvantage of this composite coating is that it does not have high abrasive resistance and under the conditions at this dam it has a tendency to tear in any inclosed angles except as these are modified; also where loads of debris plus snow and ice occasionally drag on the coating with a downward motion, wear results. Floating debris is regularly removed to reduce abrasion causes. However, up to the present time maintenance costs have not been heavy.

Application procedure

For installing the membrane, scaffolds were built with a curvature the same as that of the arch barrels on a horizontal plane. Raised and lowered by tackle these scaffolds were operated on rubber-tired wheels to prevent abrasion of the coating.

Beginning at the bottom of an arch barrel the concrete was first cleaned with chipping or bushing hammers that cut deep enough to expose a clean, sound surface. This work progressed up the face of the dam, and was finished with the scaffold at the top of the arch barrel. On the return trip down the face, the newly exposed surface was cleaned with washing jets in which compressed air was combined with water to add the effect of impact. Starting then from the bottom of the barrel the next trip was made upward to repair open cracks, fill in low spots and smooth up the surface generally.

Some joints chipped out

Because some leakage had occurred at construction joints, special attention was given to these locations. Where cracks were found at these joints they were first chipped out on the upstream side to sound material and were then given a heavy bituminous coating. On some cracks that required more preparation, shotcrete was applied, otherwise a primer coat was put on after which the asbestos cement was used to build up the surface to uniform curvature. On top of all such joint repair a strip of

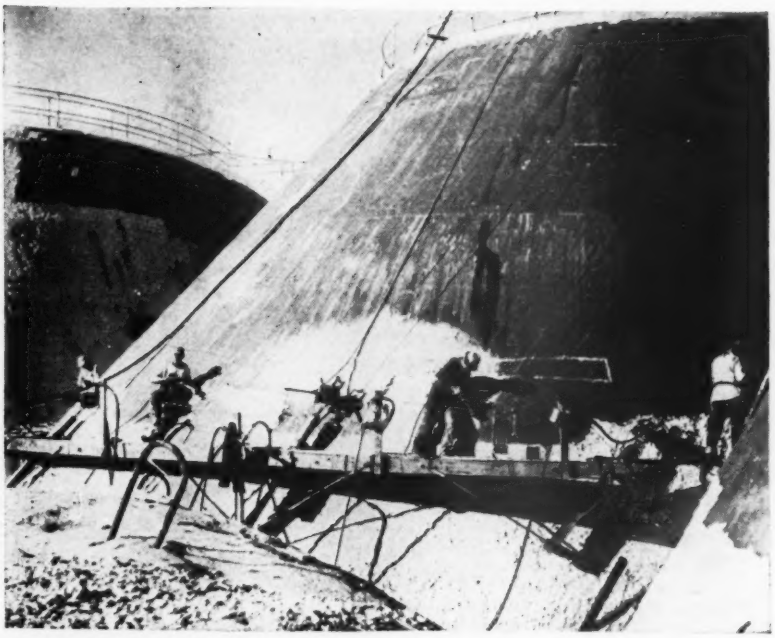


Fig. 2. Old asphalt coating and weathered concrete were chipped off with air hammers. This view is at the base of a low arch section.

Fig. 3. The rubber-tired scaffold was lowered as the work progressed in troweling on the plastic coatings and placing the asbestos-felt layer.

Fig. 4. When the reservoir was full, moisture worked its way through the construction joints.

30-lb. asphalt-saturated asbestos felt, 10¾-in. wide was put on, extending equally above and below the center line of the joint. These strips were fastened in place with ¾-in. concrete nails driven on 12-in. centers.

Preparatory work was also done on the narrow space in the groins between adjacent arches. Out of these were cleaned all debris and loose asphalt coating, and they were then filled with shotcrete, after setting on the centerline a fiber board panel ½ in. thick to serve as a contraction joint. This shotcrete application was made thick enough so that the transition of the felt coating from one arch barrel to that adjoining could be made on a smooth easy curve.

Convenient work schedule

With the surface thus prepared for the impervious coating, the scaffold was started up from the bottom, applying a primer coat consisting of an asphalt cutback. The work was scheduled so that the primer crew would finish at the top of an arch barrel in the evening and leave the scaffold there.

Next morning the crew could start down, applying the several layers needed to complete the treatment. The first was a $\frac{1}{16}$-in. minimum thickness layer of asbestos cement which was troweled over the surface to get a uniform spread. As soon as this became "tacky," there was laid over it a 15-lb. sheet of asphalt-saturated asbestos felt.

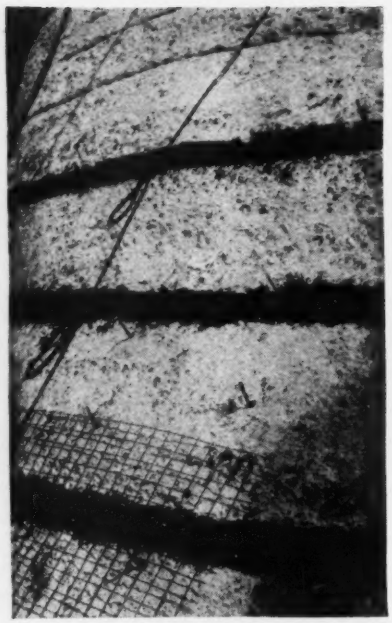


Fig. 5. Construction joints at 4-ft. intervals were chipped out and refilled with waterproof material. Where the concrete had to be cut away deeply the surface was brought up to grade by shotcrete over wire mesh.

Lapped Joints

This strip, 33 in. wide, was fastened along the upper edge with ¾-in. concrete nails and tin disks spaced not more than 12 in. apart. The strips were lapped a minimum of 2 in. on horizontal joints and 3 in. on vertical joints. The laps were cemented with the asbestos cement, and laid shingle-fashion, with the upper sheet extending not less than 1 in. below the nails holding the upper edge of the lower sheet. This felt had perforations to permit escape of gas formed by the setting of the bonding material on the under side.

Finally, and on this downward passage of the scaffolding, there was laid a ⅛-in. top coating of asbestos cement applied over the roofing felt. This constituted the final construction and the scaffold was removed at the bottom of the arch barrel. In the following season, after the asbestos cement had thoroughly cured and hardened, the exposed face was given a spray coating of light-reflecting paint, either aluminum or lead-and-oil, to minimize heat absorption.

Joint leaks explained

In considering why there was leakage at the construction joints, which are about 4 ft. apart, it is pointed out that these joints were finished off after each pour with the surface horizontal, as is the approved practice. The planes in which the arch segments lie, however, are at an angle of about 45 deg. to the horizontal. The "breathing" of the arches under movements occasioned by adjustment to temperature stresses thus tends to open these joints. Studies of this situation have shown that the joints moved most on hot days, when the arches were unloaded, and least when the arches were under load.

The investigations of materials and the program for waterproofing this dam were carried on by the engineering staff of the Southern California Edison Company under direction of W. L. Chadwick, manager of engineering.

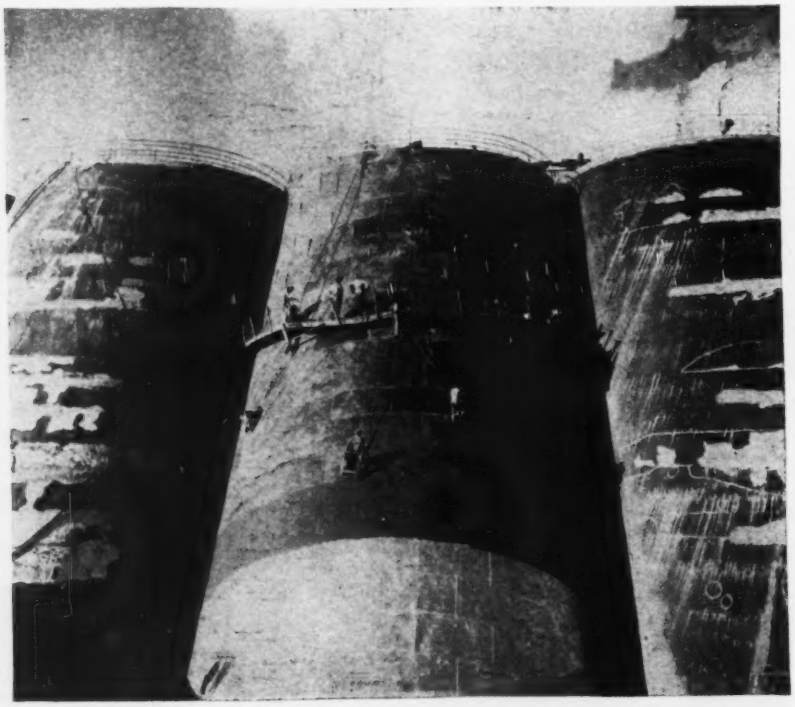


Fig. 6. One arch of the dam was faced with welded steel plates. In the reconditioning, these plates were cleaned and painted with an asphaltic material followed by aluminum paint to reduce heat absorption.

Fig. 1. Excelsior Mills rayon tire-cord plant, Clemson, S. C., contains many facilities for workers' comfort.

New Trends Develop in Southern Textile Mill Design

***Contents in Brief**—Resorting to air conditioning to meet process requirements, designers of textile mills in the South find that for economy of maintenance and operation buildings must be insulated. In new plants, windows are reduced to a minimum, replaced by glass block or eliminated entirely. An inspection of typical plants shows how air conditioning, lighting and floor, wall and roof materials have been used to supplement each other.*

TEXTILE MILLS in the South are changing in architectural and structural design from what are usually considered traditional mill buildings. In general, air conditioning has affected the design of the newer plants to the extent that windows are reduced to a minimum and floors, walls and roofs insulated. Additions are being made to older mills to house air-conditioning apparatus, and windows are being bricked in. Other trends are also noticeable, but the effect of air conditioning is the most outstanding.

The overall design of the new mills depends to a large extent on the location and processes involved. The former, as a rule, is chosen for availability of labor, power, water and transportation; ease of expansion; and low cost of land. For these reasons, many of the new plants are located from one to five miles, sometimes even more, outside city limits.

The appearance of the mills, landscaping and working conditions are made as pleasant as possible to attract employees, with some plants including smoking, rest and lunch rooms, sometimes also cafeterias. In some cases, homes for key employees are erected by the manufacturer on the site.

A good example is the new rayon tire-cord plant of Excelsior Mills, built and operated by Deering, Milliken & Co., Inc., on the Southern Railroad near Clemson, S. C. (Fig. 1). Facilities for the comfort and welfare of employees include an intercommunication system that can be used for broadcasting music, a cafeteria with built-in projection booth for showing educational films, and tiled toilets, showers, washrooms, first-aid room and drinking fountains. Adjacent to the plant, 50 homes with brick veneer exteriors have been built for use by key employees. Some of these are visible in the upper right corner of Fig. 1.

One-story plants numerous

Because of rural locations, employee parking has to be provided, since automobile transportation is the principal means by which workers get from their homes in nearby cities to the out-of-town plants. Another effect of suburban sites is the predominance of one-story structures. Because land in rural areas is relatively cheap, one-story buildings are preferred whenever production lines can thus be satisfactorily housed.

In general, in the new plants wide column spacings are desired to provide a minimum of interference between the structural frame and production equipment. Typical bays in the new mills are about 1,000 to 1,500 sq. ft. in area, and to meet the requirements for long spans economically, the plants have structural steel frames, which usually are riveted. The bays vary in shape from the

Fig. 2. Divided into 20 x 52-ft. bays, the interior of the U. S. Rubber Co. mill at Scottsville, Va., is illuminated throughout by fluorescent lighting. Unit air conditioners are located in the roof trusses.

square panel, 30 x 30 ft., used in the Excelsior Mills building to the 20 x 52 ft., adopted for United States Rubber Co.'s rayon tire-cord mill at Scottsville, Va., (Fig. 2) and the 28 x 100 ft. used in Ware Shoals Manufacturing Co.'s rayon finishing plant at Ware Shoals, S. C., (Fig. 5).

Processing requires air treatment

To some extent air conditioning is installed in textile mills for human comfort, but by far the most important reason is to meet process requirements. Refrigeration is sometimes uneconomical because the machines throw off considerable heat and, therefore, to keep summer temperatures from reaching excessive values, evaporative cooling is often used.

The principle on which evaporative cooling works is that a given volume of air can absorb heat without increasing its dry-bulb temperature, if moisture is added to it. Thus, if water is dispersed in a manufacturing area by atomizers, the air is enabled to absorb the heat given off by the machinery and processes without a rise in dry-bulb temperature. Then, the damp, hot air is expelled from the room, to be replaced by relatively dry air. Heat is transported outside by this process, leaving the inside temperature and humidity conditions at a desirable level for efficient operation.

In the Excelsior Mills plant, central-station air conditioning is based on 57 percent relative humidity and 80 deg. F. inside and +10 deg. outside, utilizing refrigeration in warm weather. Air for the offices and cafeteria is drawn from the main room and is reconditioned.

Unit air conditioners used

Unit conditioners are used in the U. S. Rubber Co. tire-cord mill (Fig. 2) to maintain 55 percent relative humidity and 92 deg. F. dry bulb with 0 deg. F. outside. There are 28 individual air conditioners over the twister section. Having a capacity of 16,000 cfm., each consists of a standard fan, a non-freeze reheater section, a humidifying section and a mixing chamber together with outside return air dampers. A 5-hp. motor drives the fan and a ½-hp. motor the spray-water circulating pump. Over the weaving section, there are two similar units of 10,000-cfm. capacity.

Conditioning equipment was provided entirely for employee comfort in the new mill built at Cornelia, Ga., for the Lumite Division of the Chicopee Manufacturing Corp. (Fig. 7), since humidification is not necessary in processing the plastic monofilaments used for insect screens and fabrics. Two central conditioning units—one for the mill rooms and the other for the offices—provide automatically regulated evaporative cooling, changing the air 14 times per

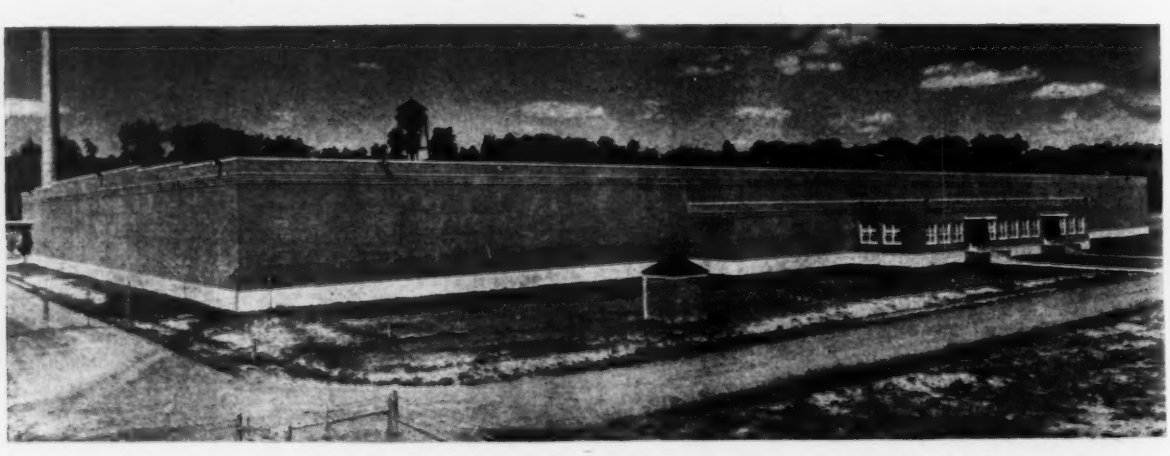


Fig. 3. U. S. Rubber Co. rayon tire-cord plant, Scottsville, Va., is air conditioned. The brick exterior walls, which are windowless except in the office section, and the precast concrete roof are insulated.

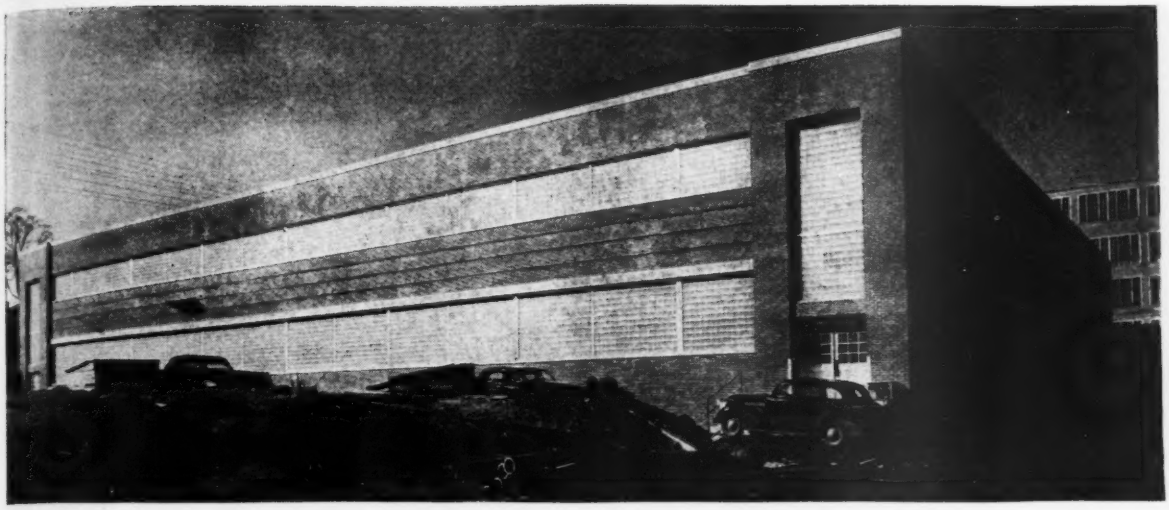


Fig. 4. Exterior walls of the Ware Shoals Manufacturing Co. rayon finishing plant, Ware Shoals, S. C., are faced on the outside with brick and on the inside with tile, with 5- and 8-ft. horizontal bands of glass block.

hour. A relative humidity of 55 to 60 percent is maintained at a temperature during the winter of about 75 deg. F. and during the summer at about 15 deg. F. lower than the outside temperature.

One of the problems encountered in the design of air-conditioned plants is location of air ducts, which might occupy considerable space, detract from the appearance of the building interior and complicate construction. When a central air-conditioning station is used, a satisfactory solution is seen in the method adopted for the Excelsior Mills, where treated air is fed through concrete ducts on the roof (Fig. 1).

Two methods are suggested when unit conditioners are employed. In the first, as used in the U. S. Rubber Co. mill (Fig. 2), the conditioners are placed in the roof trusses above the bottom chord, with catwalks extending the full length of the room providing ready access for inspection and maintenance. The exhaust vents are located on the roof. The alternative method, used in a new mill at Halifax, Va., is to locate the units in windowless roof monitors.

Should buildings be windowless?

Engineers agree that windowless buildings are desirable for air-conditioned plants but some believe that windows are often justified. Without windows, walls transfer less heat so that lower capacity air-conditioning and heat systems are required, reducing the capital investment; the cost of operation of these systems is decreased; and temperatures can be maintained more uniformly throughout the building. Investment in awnings, curtains or blinds is also avoided, as well as the maintenance associated with these items.

Some engineers believe that windowless walls are less expensive to construct. They point also to the relatively high cost of sawtooth construction, whose purpose of providing daylight uniformly throughout the mill is often thwarted because the glass on other than northern exposures is eventually painted blue to reduce the glare. Furthermore, if windows are provided, they say, unenlightened employees will open them—sometimes even break the glass to do so—nullifying the the benefits of air conditioning.

For these reasons, the one-story Excelsior Mills and U. S. Rubber Co. plants are windowless, except in the office portions. The former (Fig. 1) is 157 x 663 ft. in size, the latter (Fig. 3) 265 x 445 ft., with the office section jutting out at about the center of the long dimension to relieve the monotony of unbroken wall.

On the other hand, most engineers favoring the use of windows concede the preceding arguments and justify windows on psychological grounds. Employees, they say, are happier if

Fig. 5. Bays of the air-conditioned mill of the Ware Shoals Manufacturing Co. are 28x100 ft. Floors will be surfaced with hard maple. Roof is precast concrete.

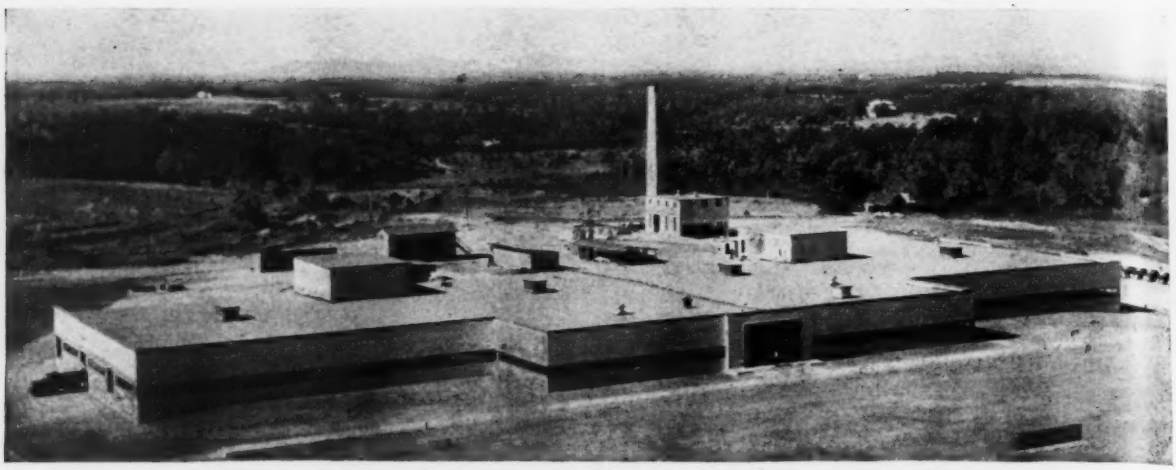


Fig. 6. Air-conditioned mill for Lumite Division, Chicopee Manufacturing Corp., at Cornelia, Ga., utilizes a continuous band of double-glazed windows in tile walls around three sides of the building.

they are able to observe the outdoors, and small windows can serve this purpose, with little loss or gain of heat and with slight increase in cost. Many architects also prefer windows to make the structure more attractive in appearance. (Elaboration of these and other factors involved may be found in *ENR* May 16, 1946, vol. p. 784, "Controlled-Conditions Buildings Compared with Conventional Factories.")

In the case of the Lumite mill (Fig. 6), window sash are double-glazed, with a dry air space between panes. The plant is 114 x 422 ft. in size, with a 37½ x 80-ft. office section, and a continuous band of windows runs the length of three sides of the building, the fourth wall being removable to permit future expansion. No provision is made for using the windows for ventilation.

Glass block are used in the Ware Shoals plant (Fig. 4) and in the Bleachery Project of The Springs Cotton Mills near Lancaster, S. C. (Fig. 8). The former is a one-story building 160 x 200 ft. in size, the latter one-story and two-story, having dimensions of 400 x 1,000 ft.

The new plants rely heavily on artificial lighting for illumination of almost their entire areas. For this purpose, fluorescent lighting is resorted to in most cases because experience with this form of illumination has been most satisfactory to date and recent developments have made available new shapes and types of lamps, increased lamp output and decreased costs (*ENR* July 25, 1946, vol. p. 105). As a rule, these installations are designed to provide from 35 to 60 ft-candles per sq. ft. at operating levels.

Fig. 7. Floors of the Lumite plant are surfaced with northern hard maple laid on a sub-floor embedded in tar concrete. Fluorescent lighting illuminates the 30 x 37½-ft. bays, which are air-conditioned.

In the Excelsior Mills plant fluorescent lighting is designed to give 50 ft.-candles. Fixtures are placed close to the ceiling in three continuous rows for each bay across the width of the building, with each row controlled by three switches to allow one-third or two-thirds of the lights to be turned on. While present installations in the U. S. Rubber Co. mill deliver 30 ft.-candles, over 50 ft.-candles are obtainable by completing the blank fixtures incorporated in the continuous row design. Intensities in the Lumite plant vary from 25 to 50 ft.-candles, depending on the work involved.

When incandescent lighting is selected for a new plant, either of two reasons are generally advanced: Spot illumination is desired or vapor-proof fixtures are necessary.

Brick and tile walls preferred

In almost all cases, the walls of the new plants are faced on the inside with glazed structural tile, selected for its attractive appearance, light re-

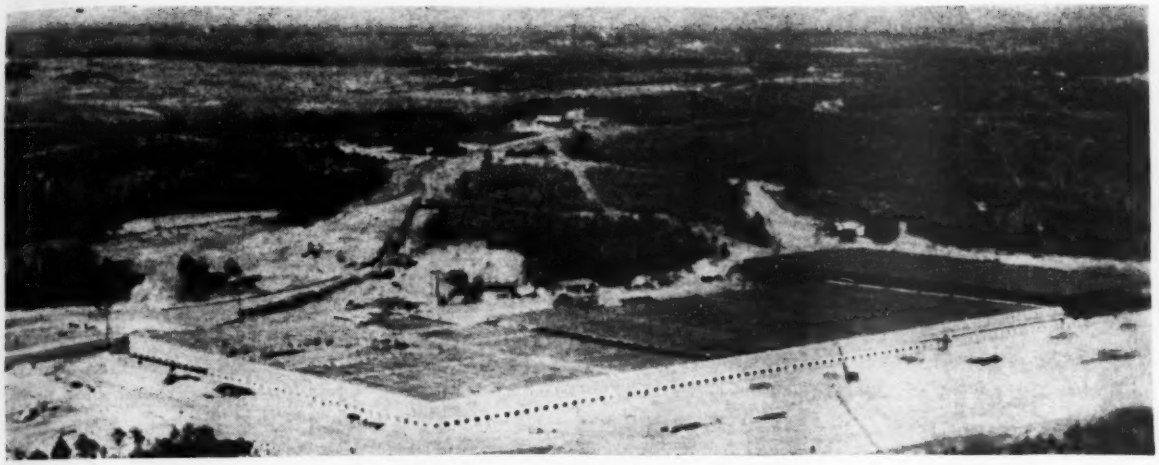


Fig. 8. Brick and tile walls with glass-block windows form the exterior of the 400 x 1,000-ft. Bleachery Project of The Springs Cotton Mills at Lancaster, S. C.

flectivity, ease of cleaning and low maintenance. Often used for the exterior too, tile has the additional advantage of not requiring painting, but brick is generally preferred for this reason as well as for its low cost and resistance to weathering.

The walls of both the Excelsior Mills and Lumite plants are entirely of tile. In the former, inside walls are faced with salt-glazed structural tile and the outside walls with spot-manganese structural tile. The exterior walls in the latter (Fig. 6) are composed of 8-in. buff-colored tile trimmed with terra cotta. Brick and glazed tile, however, are used in the Ware Shoals building (Fig. 4).

In a few cases, from two to four inches of insulation are added to the masonry walls to keep heat transfer to a minimum. For this purpose, insulation in the form of rigid blocks is usually selected for ease of installation, with preference given to fireproof, waterproof and vermin-proof materials. For example, the exterior walls of the U. S. Rubber Co. mill (Fig. 3) are composed of 12-in. brick, 2 in. of this type of insulation and 4-in. brick veneer.

Roof construction

Particularly in the case of large one-story plants, rigid-block insulation is also commonly used for roofs, which more often than walls have insulation added. With a tar-and-gravel built-up roofing over it, rigid insulation is being used to a large extent on the flat, monitorless roofs that are predominant among the new textile mills.

A wood deck is preferred for the roof by some engineers because it is normally low in cost, can be used on longer spans than other materials commonly specified, is lightweight and lends itself to easy anchorage of pipes, ducts and other overhead installations. The wood is generally treated with creosote or salts to protect it against termites and rot.

To some extent because wood is not currently available, but sometimes out of preference, other materials are often used for the roof. Precast concrete is a common choice, while light-gage steel deck makes an occasional appearance. These materials can be placed rapidly and do not support combustion, and furthermore, anchorage to the steel deck has been simplified as a result of the development of a stud welding gun.

Mill floors a problem

Selection of adequate flooring for the different parts of textile mills is not simple. An ideal floor should be "foot-warm", bright, durable, hard, sturdy and easy to clean. It must be resilient to reduce the strain of walking, resistant to the abrasive effect of truck wheels, and capable of supporting machinery without excessive deflection, yet damp out vibrations. In manufacturing areas, loads vary from 100 to 200 psf., including allowances for vibration, and in warehouses up to 300 psf.

One of these requirements may be eliminated to simplify the problem, in that through the use of rubber-tired wheels, floors may be protected against extremely abrasive wear, thus reducing the need for a very hard surface. On this basis, a northern hard maple floor laid in asphalt on wood joists resting on or embedded in a tar-concrete base is generally preferred in dry-process rooms. Hard maple is used for the floor in almost all of the recently built plants.

Floors for wet processes

Two types of floors are being used for wet-processing areas: cement with special surface and glazed tile. Hardened by admixtures, the cement floor is often chosen because it is not as slippery as tile, but the latter is claimed to be harder and easier to clean and to require less maintenance.

Perhaps the U. S. Rubber Co. mill's dry-process floor, designed for resilience, vibration absorption and moisture resistance, may be considered typical. Here, a 4½-in. tar-concrete base (3 in. of tarred rock plus 1½ in. of tarred sand) is laid, in which is embedded 3-in. creosoted square-edge timbers securely toe-nailed. On this is attached ¾-in. salt-treated pine intermediate flooring, a layer of waterproof paper and $\frac{25}{32}$-in. square-edge hard-maple flooring, face nailed.

J. E. Sirrine & Co. of Greenville, S. C., designed and Daniel Construction Co., also of Greenville, built the Ware Shoals, Excelsior Mills and U. S. Rubber Co. plants. Robert & Co. of Atlanta, Ga., designed the Lumite and Springs Cotton Mills Co. projects, the former being erected by Daniel Construction Co. and the latter by the manufacturer's own forces.

Curbs Built of Asphaltic Concrete To Cut Highway Maintenance Costs

***Contents in Brief**—Curb and gutter built of hot-laid asphaltic concrete are being added in cut sections on U. S. Route 1 in Maryland to reduce a major maintenance problem. The gutter is first paved and then the curb is added as a second operation. Although hand tools are used for all operations, costs are considered reasonable.*

TO REDUCE maintenance costs on heavily traveled U. S. Route 1 between Baltimore and Washington, crews of the Maryland State Roads Commission are adding curb and gutter built of hot-laid asphaltic concrete at those locations where the road is in cut. Although this project is the first of its type by the Maryland department, experience to date indicates that the work will pay large dividends.

The work was begun last August and by March 1 some 11 miles of the highway had been improved in this manner in the rural sections north of the town of Laurel. At this location Route 1 provides two lanes of flexible pavement in each direction. The traffic carried includes a large percentage of trucks, and maintenance crews have found it difficult to adequately maintain the shoulders and to prevent erosion of the gutters.

A few years ago maintenance of the shoulders was reduced by adding gravel or other stabilizing material adjacent to the pavement and surface treating the shoulder with tar. In the cut sections a gutter about 3½ ft. wide and a curb 8 in. high are now being added to reduce the maintenance work still further and to provide an overall shoulder width of 8 ft. The compacted thickness of the gutter pavement is 3½ in. and its slope toward the curb varies from ½ to 1 in. per foot, dependent upon the longitudinal grade of the roadway.

Asphaltic concrete more economical

Before deciding on the use of hot-laid asphaltic concrete for the curb and gutter, consideration was given to the use of portland cement concrete. However, the asphaltic concrete was selected because engineers of the Maryland department believe that this type of construction is most economical, requires less preliminary work, permits small areas to be paved easier than with portland cement concrete, and the asphaltic concrete will suffer less damage in those areas where settlement of the underlying soil occurs.

All excavation and fill work for the curb and gutter is accomplished with hand tools, since the width of the gutter must be varied from section to section and mechanical equipment cannot be used effectively. A steel form made up in 10-ft. sections and of the type used to construct portland cement pavements is installed for the back face of the curb. Two steel pins per section have proven sufficient.

An asphaltic concrete meeting the "B" specifications of the Maryland department and purchased from a nearby commercial plant is used. The aggregate consists of crushed stone meeting the following gradation:

Sieve Size	Percent Passing
1 inch	100
¾ inch	85 to 100
½ inch	60 to 95
No. 4	40 to 75
No. 10	25 to 55
No. 40	10 to 35
No. 80	6 to 28
No. 200	4 to 10

To this aggregate is added sufficient asphalt of 85 to 100 penetration to make the bitumen content of the mix 5½ to 8 percent on a weight basis.

Curb is built later

The concrete is delivered to the job at a temperature of about 300 deg. F. in end-dump trucks. It is transferrred to the forms and compacted with hand tools. As a first operation the gutter is paved for its full width plus the width of the curb, which permits the curb to be added later—usually the same day—as a separate operation (Fig. 1).

In constructing the curb, 1 x 6-in. wood strips are tack nailed on the gutter slab to indicate the desired position of inner edge of the curb. The concrete for the curb is roughly shaped by shovel by the men delivering the material to the forms, and then the curb is readily finished by a

Fig. 1. General practice is to add the curb as a second operation after a section of the gutter has been paved.

workman using a heavy wooden trowel. Normal practice is to remove the form for the curb the next day and to backfill behind the curb at the same time.

Although the curb and gutter are being added in a rural section, numerous entrances to the highway had to be provided. At these points timber forms extending about 3 ft. beyond the gutter are installed (Fig. 2). The pavement for the entrances is made about 3½ in. thick or the same as the gutter. Barricades are used at the driveways to keep traffic off of the newly compacted asphaltic concrete for about four hours.

The paving crew is usually made up as follows: One foreman, two truck drivers, two common laborers, and eight prison laborers. When constructing the gutter this crew uses a 6-ton batch of concrete about every three-quarters of an hour. Nearly 10 lin. ft. of the curb and gutter is built with one ton of material.

Cost of the concrete at the commercial plant varies from $4.50 to $5.25 per ton, and in place about $7.22 per ton. Total cost of the curb and gutter where the latter averages 3½ ft. in width is approximately $0.73 per lin. ft., based on the cost studies for a long section where the average haul of the concrete was four miles. The $0.73 figure is made up as follows:

Operation	Cost per lin. ft.
Excavation	$0.079
Distributing forms	0.021
Setting forms	0.026
Placing and finishing concrete	0.137
Removing forms	0.012
Asphaltic concrete	0.460
Total	$0.735

The wage rate paid the common labor is $0.70 per hour and that for the prison labor 47½ cents. Because of the greater efficiency that would result, it is believed that the cost would be no higher if no prison workers were used.

Results of the work to date are considered promising and the Maryland department is continuing the improvement program as needed. The work is being done by District Number 3 of the Maryland State Roads Commission with headquarters at Laurel. For this district E. G. Duncan is district engineer. Walter Sayers, as maintenance engineer, is in general charge of the work and Hobart Noll is in direct charge.

Fig. 2. Entrances to driveways are also paved, low wood forms being used for this work.

Fig. 3. In some locations a gutter pavement as wide as 10 ft. is required to end serious erosion. Because of the varying width of the work, hand tampers weighing from 8 to 10 lb., rather than mechanical equipment, are used for the compaction work.

Fig. 4. To eliminate the dangerous practice of school buses stopping on the roadway pavement paved turnouts are being constructed at many locations.

Construction Cost of 1946 Homes

THE lowest construction cost for privately financed housing started in 1946 in 29 widely scattered industrial areas in the U. S. was $4,200 per dwelling unit and the top cost was $9,100 per unit, according to a comprehensive survey just completed by the Bureau of Labor Statistics of the Department of Labor and summarized in the accompanying table. Other data made available reveal that the low unit cost for the housing begun last year in 30 urban counties was $2,900 and the high $6,900. These figures are for construction alone and do not include land or the cost of extending such utilities as water mains to the housing site.

Completion time varies widely

The time required for construction is indicated as varying widely, but with most projects requiring at least six months from the start of construction to completion.

Since the spring of 1946, the field forces of the BLS have been collecting data pertaining to privately financed housing. However, the reproduced table has just been completed and represents what is believed to be the most comprehensive data on housing costs to come out of Washington since the housing program was begun.

Data have been collected monthly from permit-issuing offices and from the building contractors in 90 areas throughout the U. S. These areas include 29 industrial regions consisting of one or more complete counties surrounding a central city, 30 entire urban counties, and 31 complete rural counties. (No data are supplied in the table for the latter areas.) Information on the total number of dwelling units started, the calculated construction cost of these starts, and estimated monthly expenditures for residential building are obtained each month for each area.

Other data on the characteristics of current housing work are collected on a quarterly basis under what is designated a cycle system of operation. With this method, characteristic data are collected once every three months in each of the 90 areas with one-third of the regions completely surveyed during each month of the quarter. Therefore, detailed data for a third of the areas are gathered monthly.

The low unit cost of $4,200 for housing started last year in the industrial areas was for 4,170 units—including single-family and multiple dwellings—begun in the Memphis area. No breakdown for the construction cost of the one-family structures alone is given. The highest cost for last year's work in the industrial areas listed occurred in the Cleveland region, where 6,860 units of all types were begun.

Further study of the data pertaining to last year's work indicates that projects in the industrial districts generally cost less in the South. For example, the average construction cost per unit during 1946 was $4,600 at Knoxville, $4,800 at Atlanta, and $4,900 for the Fort Worth area. In contrast, the average cost was $8,000 in the Chicago area, $8,600 in the Hartford region, and $7,500 in Minneapolis and in the New York area, which includes Newark and Jersey City.

Continued analysis reveals that of the industrial areas surveyed, more 1946 activity occurred in the Los Angeles area, where 54,380 dwelling units were begun last year, than in any other region. This figure compares with 40,675 units begun in the New York area, 18,760 units in the Chicago area, and 17,075 units in the San Francisco region.

Lower costs in urban areas

Study of the data supplied for the 30 urban counties shows that, in general, construction costs were lower in these areas than for the industrial centers listed. In the urban regions surveyed, the lowest cost for work begun last year was $2,900 in the Mobile County, Ala., area, while the high was $6,900 per unit for the projects started in Dade County, Fla., in which the city of Miami is located.

Surveys during the last quarter of 1946 further revealed that a high proportion of the dwellings begun last year in almost all the areas studied were of the one-family detached type. In the industrial areas between 80 and 90 percent of the housing projects permits issued during the months studied were for one-family detached homes. An exception to this trend was in the New York area, where 52.5 percent of the permits issued in October were for structures to house five or more families and another 17.8 percent were to accommodate two to four families. Boston is also an exception, as the permits issued in October in this area indicated that 57.1 percent of the units were to be made up of structures accommodating five or more families.

Many one-family dwellings

Studies in the urban counties also revealed that most of the building permits issued late in the year in these areas were for one-family homes. The only major exception is Dade County, where about 20 percent of the approved permits were for other than one-family structures, and in Palm Beach County, Fla. In the latter region 23 percent of the permits were for structures for two to four families and 5 percent for apartment buildings accommodating five or more families.

Data regarding the time required for construction were obtained by interviews with housing contractors a few weeks after the permits for the projects were issued. Therefore, to a certain degree, the original data were forecasts or estimates. However, the projects for which building permits were issued in May, July and September and previously studied were resurveyed in December, 1946. This resurvey provided the data presented at the right in the table for these months.

Expected time for construction is also listed for projects begun in October for a number of areas, for considerable work started in other regions in November, and for projects begun in December in still a third group of areas.

Privately Financed Dwelling Units in 1946

Number of Units Started, Average Construction Cost and Average Construction Time.

(Compiled by the Bureau of Labor Statistics, U. S. Department of Labor)

AREA	Units Started During 1946 (all types)			Units for Which Permits Were Issued During Fourth Quarter of 1946[1] (Data pertain to month shown at left)																Average Number of Months from Start of Construction to Completion (all types)					
					Percentage distribution by type of structure			Construction Cost Classification[2]																	
								All Types							1-Family										
									Percentage distribution							Percentage distribution									
	No. of units	Total constr. cost ($000)	Ave. constr. cost per unit	Month[3]	1-Family	2-to-4-Family	5- or More Family	Ave. per Unit	Under $3,250	$3,250-$5,249	$5,250-$7,249	$7,250-$9,249	$9,250 & over	Ave. per Unit	Under $3,250	$3,250-$5,249	$5,250-$7,249	$7,250-$9,249	$9,250 & over	May, 1946, projects[4]	July, 1946, projects[4]	Sept., 1946, projects[4]	Oct., 1946, projects[5]	Nov., 1946, projects[5]	Dec., 1946, projects[5]
29 Industrial Areas[6]																									
Atlanta	6,785	32,410	4,800	Oct.	100.0	....	....	5,300	21.0	27.8	17.5	22.3	11.4	5,300	21.0	27.8	17.5	22.3	11.4	5.2	3.7	5.4	3.7	.....	.....
Boston	5,220	37,942	7,300	Oct.	42.4	0.5	57.1	5,600	[8]	[8]	[8]	[8]	[8]	6,900	4.2	25.6	15.3	37.6	17.3	7.5	7.1	5.5	6.9	.....	.....
Buffalo	3,065	20,500	6,700	Nov.	95.5	....	4.5	7,600	....	6.7	25.9	47.2	20.2	7,800	....	2.4	27.1	49.3	21.2	8.8	7.0	5.8	.....	5.0	.....
Chicago	18,760	150,603	8,000	Oct.	92.7	5.0	2.3	7,900	2.6	6.5	25.7	37.2	28.0	8,000	2.9	7.0	23.2	36.7	30.2	6.8	5.9	6.3	5.0	.....	.....
Cleveland	6,860	62,453	9,100	Oct.	92.0	....	8.0	9,100	[8]	[8]	[8]	[8]	[8]	9,000	....	3.8	5.6	41.0	49.6	7.7	8.2	6.0	7.0	.....	.....
Columbus	2,690	18,928	7,000	Dec.	77.6	11.2	11.2	8,000	9.5	.....	49.3	31.7	9.5	7,400	11.3	.....	58.5	18.9	11.3	8.0	7.7	6.9	.....	.....	5.4
Dallas	5,820	37,469	6,400	Oct.	87.0	7.1	5.9	6,500	4.9	24.4	36.8	19.6	14.3	6,700	5.7	21.2	34.1	22.6	16.4	4.4	4.3	3.6	3.7	.....	.....
Denver	6,785	40,321	5,900	Oct.	88.9	0.6	10.5	5,700	8.2	23.5	49.4	14.4	4.5	5,800	9.1	15.5	54.6	15.9	4.9	8.2	7.6	7.1	6.4	.....	.....
Detroit	16,320	116,221	7,100	Nov.	100.0	....	....	7,200	2.6	11.9	24.1	55.9	5.5	7,200	2.6	11.9	24.1	55.9	5.5	8.3	7.7	6.1	.....	5.4	.....
Fort Worth	3,725	18,151	4,900	Nov.	100.0	....	....	4,700	21.3	17.3	39.1	16.2	6.1	4,700	21.3	17.3	39.1	16.2	6.1	5.3	4.2	3.3	.....	2.4	.....
Hartford	1,405	10,704	7,600	Nov.	99.3	0.7	....	8,200	2.3	2.4	4.2	81.7	9.4	8,200	2.6	2.5	3.5	81.9	9.5	7.0	7.9	5.7	.....	5.6	.....
Indianapolis	2,695	15,274	5,700	Oct.	92.3	2.8	4.9	4,900	28.7	26.2	36.9	4.1	4.1	5,000	30.4	21.7	39.3	4.3	4.3	6.6	6.2	5.9	4.0	.....	.....
Knoxville	2,495	11,428	4,600	Dec.	96.9	3.1	....	5,100	44.2	13.4	18.6	18.6	5.2	5,200	42.7	13.8	19.1	19.1	5.3	8.4	5.9	4.6	.....	.....	3.9
Los Angeles	54,380	347,960	6,400	Nov.	82.9	11.7	5.4	6,900	14.2	11.1	24.7	38.1	11.9	7,100	12.3	9.0	20.3	45.6	12.8	7.6	5.5	5.6	.....	4.8	.....
Memphis	4,170	17,345	4,200	Nov.	90.5	9.5	....	4,400	42.4	37.0	12.3	3.5	4.8	4,400	42.7	41.8	10.0	4.0	1.5	6.4	5.1	5.1	.....	3.5	.....
Milwaukee	4,395	33,571	7,600	Nov.	65.3	22.9	11.8	7,600	0.8	6.2	34.9	33.0	25.1	8,100	1.2	1.8	31.6	30.4	35.0	8.3	6.7	6.6	.....	6.2	.....
Minneapolis	6,910	51,777	7,500	Dec.	84.4	15.6	....	8,300	....	11.0	18.1	43.5	27.4	8,400	....	12.9	11.8	46.3	29.0	9.2	7.5	6.7	.....	.....	6.1
New York-Newark-Jersey City	40,675	306,786	7,500	Oct.	29.7	17.8	52.5	7,500	0.3	2.6	52.5	26.4	18.2	9,300	0.9	1.6	5.3	47.3	44.9	9.5	12.4	9.1	9.6	.....	.....
Philadelphia-Camden	10,560	72,300	6,800	Nov.	93.4	5.9	0.7	7,100	2.7	13.9	34.7	44.4	4.3	7,300	0.6	10.3	37.2	47.3	4.6	9.4	8.2	5.9	.....	6.5	.....
Pittsburgh	5,705	37,640	6,600	Dec.	88.7	11.3	....	7,600	3.1	7.9	46.2	20.2	22.6	7,800	2.2	6.2	43.3	22.8	25.5	8.4	7.0	6.7	.....	.....	6.1
Sacramento	4,290	20,707	4,800	Dec.	96.3	3.7	....	5,000	13.7	35.3	34.0	9.8	7.2	5,000	14.3	34.7	33.3	10.2	7.5	6.4	5.6	5.0	.....	.....	4.1
San Francisco Bay	17,075	128,017	7,500	Oct.	83.8	14.4	1.8	7,700	4.6	6.4	17.9	56.5	14.6	7,900	5.0	6.4	12.6	58.5	17.5	8.2	6.4	6.3	5.3	.....	.....
Seattle-Tacoma	8,865	51,887	5,900	Oct.	100.0	....	....	4,800	38.4	21.2	12.4	25.8	2.2	4,800	38.4	21.2	12.4	25.8	2.2	7.7	7.2	7.4	5.7	.....	.....
Springfield-Holyoke	1,175	7,137	6,100	Dec.	100.0	....	....	7,400	....	8.1	14.9	77.0	....	7,400	....	8.1	14.9	77.0	....	7.8	7.7	6.9	.....	.....	5.6
St. Louis	6,565	39,940	6,100	Oct.	91.2	7.2	1.6	7,000	11.5	14.7	27.7	28.1	18.0	7,000	12.8	13.2	26.5	31.4	16.1	7.2	6.2	5.9	5.5	.....	.....
Syracuse	1,010	7,214	7,100	Oct.	97.9	2.1	....	9,100	8.5	19.3	22.3	17.0	32.9	9,400	8.7	17.4	22.9	17.4	33.6	8.1	5.8	7.0	6.6	.....	.....
Washington, D.C.	10,890	80,382	7,400	Oct.	60.4	1.4	38.2	6,800	....	29.8	11.9	51.3	7.0	7,900	....	8.4	16.1	68.0	7.5	8.5	6.3	6.0	5.7	.....	.....
Worcester	1,535	10,057	6,600	Oct.	94.7	5.3	....	7,600	14.9	17.8	19.6	32.8	14.9	7,700	15.6	14.6	20.4	33.9	15.5	7.8	7.8	6.2	6.0	.....	.....
Youngstown	1,180	8,338	7,100	Nov.	[8]	....	....	[8]	....	....	....	....	....	[8]	....	....	....	....	....	7.9	5.5	5.8	.....	5.7	.....
30 Urban Counties[7]																									
Adams, Ill.	130	803	6,200	Oct.	100.0	....	....	6,700	....	9.1	36.4	54.5	....	6,700	....	9.1	36.4	54.5	....	9.0	7.3	5.8	5.4	.....	.....
Cass, N. D.	285	1,480	5,200	Oct.	100.0	....	....	5,600	5.0	5.0	55.0	15.0	20.0	5,600	5.0	5.0	55.0	15.0	20.0	7.1	4.3	5.1	6.4	.....	.....
Chatham, Ga.	905	3,278	3,600	Oct.	94.1	5.9	....	3,600	60.4	28.0	11.6	....	....	3,500	63.5	29.2	7.3	....	....	4.8	4.1	3.8	2.1	.....	.....
Chittenden, Vt.	145	845	5,800	Dec.	100.0	....	....	6,500	....	....	100.0	....	....	6,500	....	....	100.0	....	....	8.2	5.7	7.7	.....	.....	6.0
Dade, Fla.	7,690	53,248	6,900	Nov.	78.6	11.7	9.7	6,500	7.0	18.4	37.0	21.2	16.4	6,800	9.4	9.5	30.7	28.5	21.9	6.3	5.6	4.7	.....	2.9	.....
Garfield, Okla.	370	1,394	3,800	Nov.	100.0	....	....	5,300	36.8	42.2	10.5	....	10.5	5,300	36.8	42.2	10.5	....	10.5	5.2	3.3	4.2	.....	2.5	.....
Gray's Harbor, Wash.	140	591	4,200	Oct.	100.0	....	....	7,100	....	20.0	60.0	20.0	....	7,100	....	20.0	60.0	20.0	....	5.3	4.0	4.9	5.6	.....	.....
Hancock, Me.	35	129	3,700	Nov.	[9]	....	....	[9]	....	....	....	....	....	[9]	....	....	....	....	....	8.7[9]	[9]	[9]	[9]	[9]	[9]
Ingham, Mich.	1,110	6,105	5,500	Nov.	95.3	4.7	....	6,100	6.7	13.3	33.3	26.7	20.0	6,100	7.1	7.1	35.7	28.6	21.5	8.9	8.2	6.3	.....	5.2	.....
Lancaster, Pa.	320	2,129	6,700	Dec.	100.0	....	....	6,400	....	....	52.6	....	47.4	6,400	....	....	52.6	....	47.4	9.1	8.8	7.2	.....	.....	4.9
Logan, W. Va.	115	470	4,100	Oct.	100.0	....	....	3,300	33.3	66.7	....	....	....	3,300	33.3	66.7	....	....	....	5.3	8.5	5.9	3.2	.....	.....
Maricopa, Ariz.	3,700	23,682	6,400	Oct.	93.5	4.5	2.0	5,500	12.6	14.4	51.4	18.1	3.5	5,800	8.5	15.2	55.3	17.2	3.8	6.4	5.2	4.7	4.5	.....	.....
Marion, Ohio	110	586	5,300	Dec.	[9]	....	....	[9]	....	....	....	....	....	[9]	....	....	....	....	....	9.4	10.2	6.1	.....	[9]	.....
Marquette, Mich.	165	754	4,600	Oct.	100.0	....	....	6,700	11.1	22.2	11.1	33.4	22.2	6,700	11.1	22.2	11.1	33.4	22.2	8.7[9]	.....	6.4	6.8	.....	.....
Mobile, Ala.	1,100	3,155	2,900	Oct.	95.8	4.2	....	4,200	46.9	3.7	42.0	3.7	3.7	4,400	44.2	3.9	44.1	3.9	3.9	4.6	3.4	2.8	3.0	.....	.....
Palm Beach, Fla.	1,845	12,250	6,600	Oct.	71.9	22.9	5.2	5,700	13.0	27.5	28.9	23.0	7.6	5,700	15.3	20.5	32.0	21.5	10.7	6.6	5.4	3.6	3.6	.....	.....
Plymouth, Mass.	715	4,608	6,400	Oct.	100.0	....	....	7,100	10.5	34.2	21.0	31.7	2.6	7,100	10.5	34.2	21.0	31.7	2.6	8.8	7.4	6.5	6.0	.....	.....
Richland, S. C.	955	5,349	5,600	Nov.	90.0	10.0	....	4,400	19.5	52.7	19.4	8.4	....	4,400	15.6	53.1	21.9	9.4	....	6.6	4.1	5.0	.....	3.5	.....
Riverside, Calif.	2,425	Not reported		Dec.	[8]	....	....	[8]	....	....	....	....	....	[8]	....	....	....	....	....	[9]	[9]	[9]	[9]	[9]	[9]
San Joaquin Calif.	1,075	6,165	5,700	Nov.	97.8	2.2	....	6,900	8.4	16.8	26.5	12.0	36.3	6,900	8.6	17.2	24.7	12.3	37.2	6.5	5.4	6.5	.....	3.7	.....
Spartanburg, S. C.	490	2,079	4,200	Nov.	93.7	6.3	....	4,500	36.8	33.2	6.6	13.4	10.0	4,500	39.2	35.8	7.2	14.2	3.6	4.7	3.9	3.3	.....	2.8	.....
St. Lawrence, N.Y.	75	367	4,900	Oct.	100.0	....	....	6,800	....	50.0	....	....	50.0	6,800	....	50.0	....	....	50.0	8.3	5.0	5.3	11.5	.....	.....
Suffolk, N. Y.	3,150	18,546	5,900	Nov.	98.7	1.3	....	5,900	18.2	20.9	30.0	18.2	12.7	5,900	18.5	21.3	28.7	18.5	13.0	8.5	7.7	6.8	.....	5.3	.....
Sussex, N. J.	275	895	3,300	Dec.	100.0	....	....	[8]	....	....	....	....	....	[8]	....	....	....	....	....	4.0	3.6	6.0	.....	.....	4.0
Tioga, N. Y.	55	198	3,600	Dec.	100.0	....	....	[8]	....	....	100.0	....	....	[8]	....	....	100.0	....	....	6.8	5.7	4.5	.....	.....	6.0
Webster, Iowa	105	516	4,900	Dec.	100.0	....	....	5,000	....	100.0	....	....	....	5,000	....	100.0	....	....	....	8.2	7.8	6.7	.....	.....	9.0
Whatcom, Wash.	305	1,489	4,900	Dec.	83.3	16.7	....	4,600	36.3	27.3	18.2	9.1	9.1	5,000	22.2	33.4	22.2	11.1	11.1	4.7	3.7	4.2	.....	.....	4.5
Wichita, Tex.	380	1,353	3,600	Oct.	100.0	....	....	2,800	63.8	22.7	9.0	4.5	....	2,800	63.8	22.7	9.0	4.5	....	3.1	4.3	2.9	2.1	.....	.....
Yakima, Wash.	630	3,284	5,200	Nov.	100.0	....	....	5,200	11.2	36.1	47.1	5.6	....	5,200	11.2	36.1	47.1	5.6	....	5.0	4.0	3.6	.....	2.5	.....
York, Pa.	500	2,969	5,900	Oct.	100.0	....	....	6,500	2.4	33.3	26.2	28.6	9.5	6,500	2.4	33.3	26.2	28.6	9.5	8.0	7.0	6.1	5.4	.....	.....

[1] Includes units started in non-permit places.
[2] Under present system of operation, only one-third of the areas are completely surveyed each month. Therefore, data for individual areas are either for Oct., Nov., or Dec., 1946.
[3] Based on contractors' estimates. Excludes land or development costs.
[4] Based on re-surveys made during Dec., 1946.
[5] Based on original surveys made either in Nov. or Dec., 1946, or Jan., 1947.
[6] Industrial areas include entire counties or groups of counties surrounding the central city or cities.
[7] Includes the entire county.
[8] Breakdown not available.
[9] No activity.

Shelter and Sanitation Facilities For a Tropical Oil Camp

Edward J. Cleary
Executive Editor, Engineering News-Record

***Editor's Note**—This is the final article in the series describing activities of civil engineers at work for the Creole Petroleum Corp., biggest oil producer in Venezuela. It relates to a visit to a "wildcat" camp under construction and reports observations made at permanent camp installations in some of the older well fields. The first article, dealing with caisson foundations in Lake Maracaibo, was published December 26, 1946, vol. p. 859. The second, (Mar. 20, vol. p. 432) told of highway building practice.*

WHEN I FIRST PROPOSED that this article might be titled "Construction Fever in an Oil Camp", some members of the editorial staff protested that this would be misleading and misunderstood. While the objection is perhaps valid, the term "construction fever" does describe the state of affairs at the Carrizal camp of the Creole Petroleum Corp., during a recent visit to Venezuela.

Houses, roads, water supply, sewers, drainage and storage structures were being rushed along at a rapid pace to accommodate men and equipment in a sparsely inhabited area of central Venezuela that gives promise of producing oil. Carrizal camp was headquarters for Creole's "wildcatters" operating in a new concession in the State of Guarico.

If the acting superintendent, H. A. Beck, did not have a fever, he certainly was exposed to its affect on others. In showing me around the camp area late one afternoon, he suddenly stopped in amazement before a half-completed building hidden in the jungle, saying: "What's that? There was nothing here when I made the rounds yesterday!"

Later inquiry revealed that it was a dormitory, on the erection of which an enterprising construction foreman had thrown a large gang of men when they had finished another job ahead of schedule. This incident seemed to dramatize the spirit prevailing in Carrizal. Most of the men were old timers in the oil industry and the business of building camps. They knew what was wanted, and apparently they needed no prodding or too much direction in getting things done.

In other words, they had "construction fever", for which the only cure is action.

Fig. 1. Operations of the Creole Petroleum Corp. in Venezuela have led to the establishment of fourteen camps. Actually most of the camps are self-contained towns complete with permanent housing, utilities and other facilities for community living. Currently under construction are camps at Carrizal (center of map) and on the Paraguana peninsula (top left).

Carrizal newest of many camps

The Carrizal camp was a good place to begin my tour of inspection of the Creole camps, fourteen of which have been built in Venezuela (see accompanying map).

This newest camp is located some 10 miles west of the town of El Sombrero, one of the terminal points of the Guarico Road now under construction. As described in an earlier article (*ENR*, Mar. 20, vol. p. 432), the Guarico Road is being built by eleven oil companies to gain access to concessions in an area where it is believed oil may be found.

Creole's concession, serviced from the Carrizal camp, contains about 784,000 acres. With only three years to exercise concession exploration rights, which were taken up in 1945, speed is of the essence in carrying out development work. Several "wildcat" wells were being drilled coincidental with camp development.

The basic layout at Carrizal includes an area for "obreros" (laborers) and one for the senior staff; there is also an industrial zone for offices, shops and warehouses.

In the labor camp two types of single story houses are used (shown on p. 94) each of which accommodates two families in separate apartments. One is of brick construction, the other of prefabricated steel. The steel houses also are used for school buildings and stores.

A major advantage cited for the steel house, aside from speed in erection (it takes 8 men an average of 2½ days to put one up), is that it can be readily dismantled and salvaged for use elsewhere should later conditions warrant abandonment of the camp.

A few brick single-story houses for married members of the senior staff were also under construction. They provide a living room, two bedrooms, kitchen and porch.

To solve the problem of housing senior-staff bachelors, several second-hand Quonset type wood huts had been secured. A little the worse for being knock apart and rebuilt, they are provided with an auxiliary pitched roof of sheet aluminum. This serves the dual purpose of keeping them leakproof during the downpours of the rainy season and also provides a sunshade that aids in keeping them cool.

Carrizal is a "war baby" hence steel oil-liner pipe was used for sewer lines instead of the usual but unobtainable cast-iron. Clay pipe is not manufactured in Venezuela.

Septic tanks serving groups of houses are installed for sewage disposal.

An ample supply of water has been developed from the Guarico River, some 9 miles from the camp. Here a treatment plant adjacent to the river includes two 200,000 gal. settling basins, three 8x16 ft. pressure filters, chlorinators and pumps.

Standard Oil Co. (N.J.) Vachon photo

Fig. 2. A section of the workers' village at Caripito in eastern Venezuela.

Camps grow into towns

The catalyst that transforms a camp like that at Carrizal into the model towns found in the older producing fields is oil. Once oil starts to flow, the camp expands, streets are paved and all the facilities are extended.

No two villages are the same, however. Variations in topography, as well as size, rule out the adoption of a standard layout other than the broad subdivision into general areas. Incidentally, it might be pointed out that recreational facilities—such as clubhouses, playing fields and eating places—are generally provided in duplicate and are virtually identical for both laborers and supervisory employees. School and hospital facilities provided by the company, are quite extensive.

Brick, hollow tile and concrete are widely used for housing although there are some of conventional wood construction. One of the determining factors in the choice of materials, of course, is their availability. At present cement is very difficult to obtain anywhere in Venezuela, which is largely dependent on imports for this commodity.

In the eastern part of the country, where Creole operates its own clay products plant, the daily output of 6,000 hollow tile and 15,000 bricks, is far below required needs at this time. Recent availability of prefabricated steel houses has given impetus to their use.

Water supply and sanitation

Sanitation measures are pretty well standardized, particularly in regard to provisions for water supply and sewage disposal.

All water, with the exception of a few well supplies, is treated and filtered. Filters are of the pressure type, housed in steel tanks. Settling basins and reservoirs likewise are of steel construction, which is not unusual in view of the universal use of steel tanks for all other oil field storage requirements.

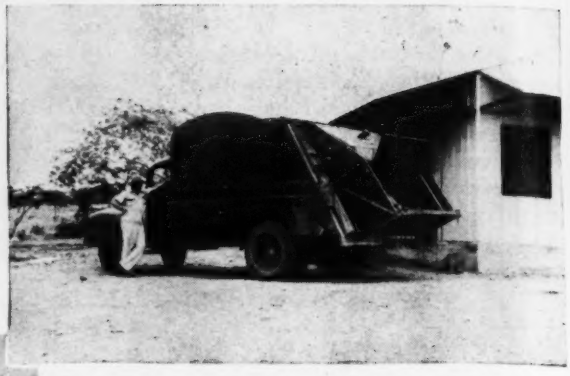
Climatic conditions in the tropics are such that only the simplest type of housing is needed for pumps and motors—virtually nothing more than a sheet metal roof.

Representative of such facilities is the plant at Caripito (Fig. 4). In addition to the four pressure filters (total capacity 1.5 mgd.) the plant includes circular steel-tank coagula-

(*Continued on page* 96)

Wildcat Camps Grow Into Finished Towns

(Above) Prefabricated steel house for laborers provides apartments for two families, each having three rooms. Hammocks, which are used for sleeping, are taken down during the day to provide greater living space.



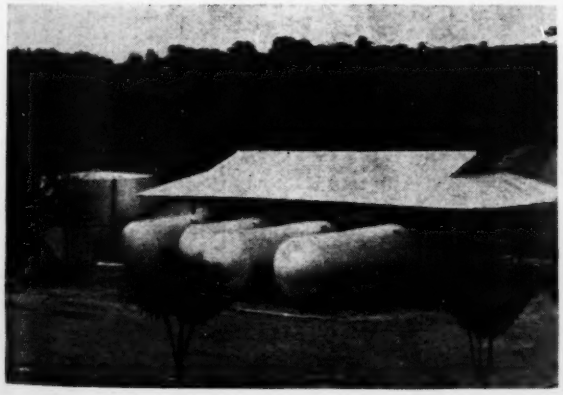
(Above) Refuse disposal service and other sanitary facilities are placed in operation coincidental with the establishment of the camp. ENR Staff Photos

(Left) Brick houses are virtually of the same size and design as the steel prefabs.

(Below) To avoid the monotonous appearance of houses in a row, advantage is taken of the rolling topography of the Carrizal, Venezuela, camp of the Creole Petroleum Corp. in the street layout.

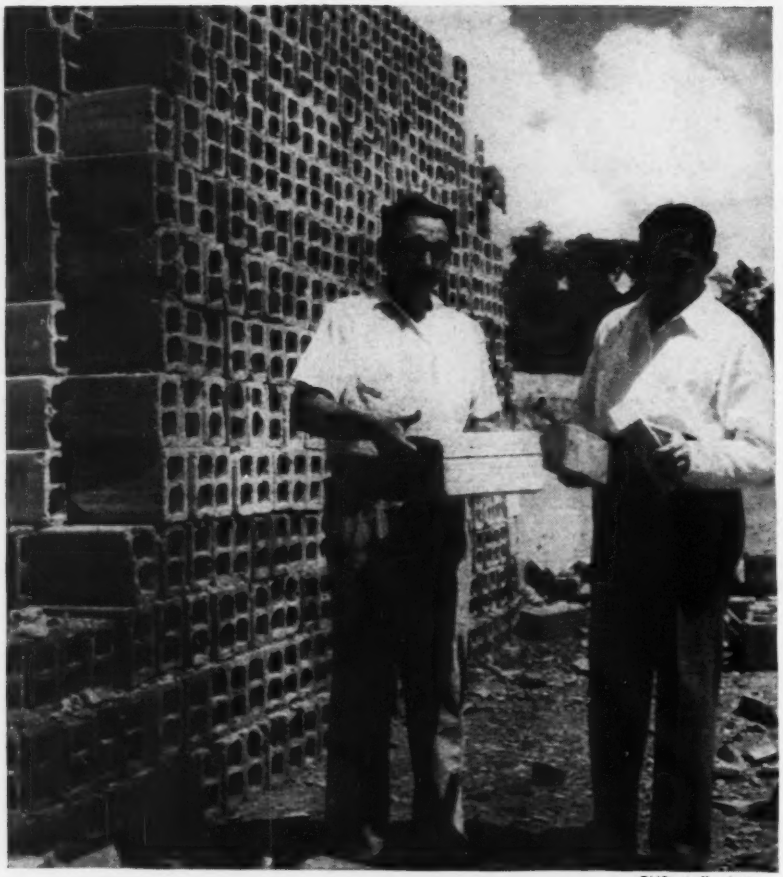
(Above) Schoolhouse for laborers' children at the Jusepin camp. Overhanging roof and facility of cross-ventilation secured with single-room building width contribute to comfort in this tropical region of eastern Venezuela.

(Right) Staff houses at the La Salina camp face Lake Maracaibo, one of the older establishments of the Creole Petroleum Corp. This camp has the atmosphere of a well-founded suburban area.



(Above) Water treatment plant at Caripito employs horizontal pressure filters. Pumps and other equipment are housed beneath a roofed structure open on all sides.

(Below) Concrete and tile-block houses at Jusepin. Living quarters are elevated above ground for thorough ventilation, and the space beneath serves for garage and storage.



ENR staff photos

Fig. 3. Hollow tile and brick for housing needs are made at the Quirquire camp of the corporation. Despite a daily output of more than 6,000 tile and 15,000 brick, demands cannot be met. The brick measures 2x4x8 in. and the tile size is 5x8x12 in.

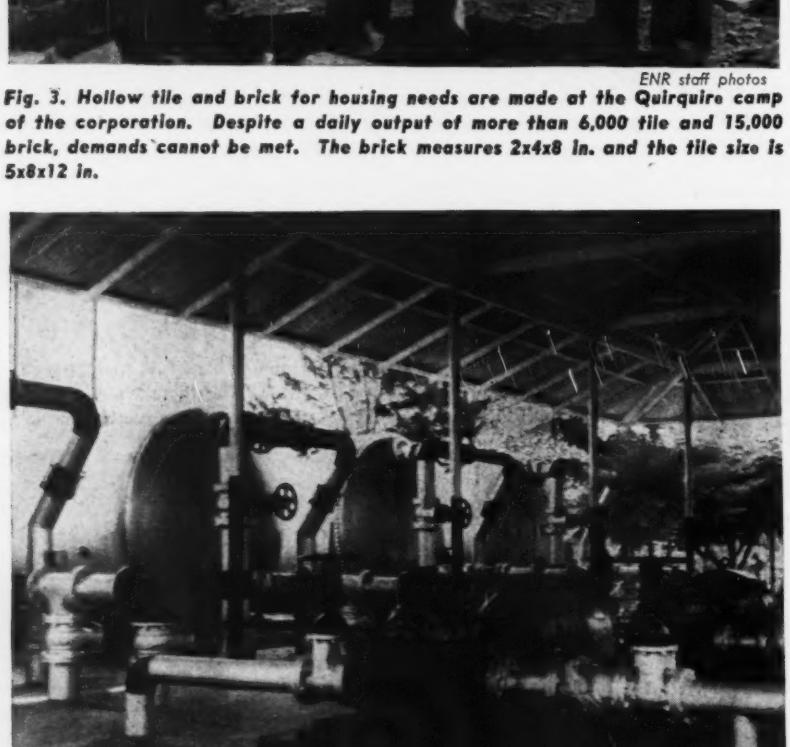


Fig. 4. Pressure filters and pumping equipment at the 1.5 mgd. waterworks for Caripito. Note the simple housing, all that is required in this tropical climate.

tion and settling basins; chlorination equipment is also provided. The source of supply is the adjacent Rio Caripe, across which a low dam was thrown to provide a pool of constant depth for the plant intake.

Serving a population of about 10,000 people, including a small refinery and ship-loading terminal, the demand on the Caripito plant is 1.1 mgd.

For sewage disposal, reliance is placed on Imhoff tank facilities.

Sanitation work extended

Creole's recently inaugurated preventive medicine and sanitation program is believed to be the only one of its kind in the petroleum industry of Latin America.

Within the company's medical department a new section has been created to provide the nucleus for intensive public health work. This central technical group consists of a sanitary engineer and a medical doctor, each with training and experience in public health, and a medical entomologist.

In each of the two oil-producing fields (eastern and western parts of the country) there will be a division sanitary engineer and a public health doctor, and in the various areas within the divisions there will be district engineers, doctors, inspectors, laboratory technicians, nurses and field entomologists.

Problems of a sanitary engineering nature that face an oil-company operation in foreign lands are not unlike those of a state department of health in the United States. They involve the design and operation of water and sewage treatment facilities, food and general sanitation problems, and the control of malaria and other insect-borne diseases.

To any industrial organization an increase in "lost time" cases represents an increase in unit production costs. For the companies who build and operate large camps the responsibilities are multiplied many times, since the family as well as the worker must then be considered.

All operations expanding

Not only sanitation but virtually every other phase of Creole operations is being expanded. This is the result of continually growing demands for oil, consumption of which

has gone up instead of down, as might have been expected at the war's end. The fact is that production today is some 25 percent greater than that on V-J Day.

As consequence, housing and service facilities at practically all the camps are being expanded to accommodate larger numbers of workers. One of the major items on this expansion program is the erection of three general hospitals, each of 100 beds. In discussing this with Hugh G. Turcot of the firm of Crow, Lewis & Wick, New York architects, it was stated that the designs for these are to be based on studies made in several South American countries. Among other things, it was learned that cooling of buildings in the tropics was probably better accomplished by means of circulation of air with fans and window orientation than through the use of more elaborate air-conditioning equipment.

Biggest single project that is under way is the construction of an $80,000,000 refinery and oil pipeline on the Paraguana peninsula in western Venezuela not far from Lake Maracaibo. A number of U. S. engineering and construction firms have been awarded contracts on this project including Williams Bros. Corp. of Tulsa, Okla., J. G. White Engineering Co. of New York and The Chicago Bridge & Iron Co. of Chicago.

Before the end of this year, Creole anticipates that some 4,500 men will be employed on construction operations. At present there are 1,000 employees working at the Amuay Bay site.

Shelter and sanitation needs will commond a lot of attention at the Paraguana refinery installation. Not the least of these facilities is a large water supply system for domestic and process uses. In addition plans are being made for complete housing, medical services, commissaries, community centers and schools.

Civil engineers of the Creole Petroleum Corp. probably will find in their present program all the action needed to cope with a good case of "construction fever."

Federal Coordinating Agency Urged for Anti-Pollution Programs

Gross pollution of rivers and streams on which 50,000,000 Americans rely for drinking water constitutes a menace to national health and welfare, Dr. Thomas Parran, Surgeon General, United State Public Health Service, declared at a recent meeting of the American Chemical Society held at Atlantic City, N. J.

Urging nationwide cooperative action by Federal and state governments and industry to halt dangerous deterioration of the country's natural water resources, Dr. Parran said that, in addition to its serious effect on health, pollution destroys necessary recreational facilities, lowers living standards in areas near unsightly and insanitary waters, and increases manufacturing costs by millions of dollars a year.

Although industrial wastes constitute the largest source of pollution, "industry has not accepted fully its responsibility to prevent development of a situation which today reacts not only to its own detriment but to that of many other groups." "The American people," he said, "should not continue to tolerate the present gross pollution of our public waters."

Establishment of a federal agency to serve as coordinator and advisor in attempts to reduce contamination was advocated by Dr. Parran, but he made no recommendation on regulatory or enforcement provisions in control legislation, explaining that Congress must determine the extent of federal police-power in this field. Police power now rests in the states.

Dr. Parran proposed, however, that uniform standards for state legislation be set up, and that state programs be expanded through establishment of regional authorities and extension of interstate compacts. Industry then would not be harassed by varying policies and no state need feel handicapped by taking the lead. Federal grants and loans might be used to encourage research and development and construction of treatment works.

Evaluation of streams is important

Dr. Parran emphasized the need to continue specific evaluation of the intensity of pollution of all the nation's river systems. Such surveys may be conducted by a single state, an interstate agency, a federal agency, or any combination of these, but the basic pattern of the studies should be agreed upon so that all the data can be collated into a nationwide picture of conditions. He called for more intensive research on all levels, public and private, to perfect control techniques and to develop methods of handling polluting materials which will be economically feasible.

Stating that the U. S. Public Health Service has been active in battling pollution for many years, and has maintained a research organization at its Water and Sanitation Investigations Station in Cincinnati for more than three decades, Dr. Parran pledged continued cooperation with state and regional authorities and offered to cooperate also with industries and groups of industries.

"We are interested in seeing workable legislation enacted, both state and federal, which recognizes the varying phases of the problem and the interests and responsibilities of all," he declared.

Federal legislation for dealing with pollution control of interstate waters should establish a federal agency with authority to conduct investigations and other activities necessary to develop more efficient methods of waste treatment, and to prepare comprehensive abatement programs, Dr. Parran said. He proposed that appropriations be permitted for grants and loans to civil subdivisions of government and loans to persons for constructing sewage and waste treatment works, and that states be permitted to form interstate compacts for united effort.

Furthermore, he urged the creation of an advisory board for the federal agency, representing other interested federal bodies, and suggested that the federal authority be empowered to keep track of completed projects, to insure maximum benefits from improvements on which federal funds are spent.

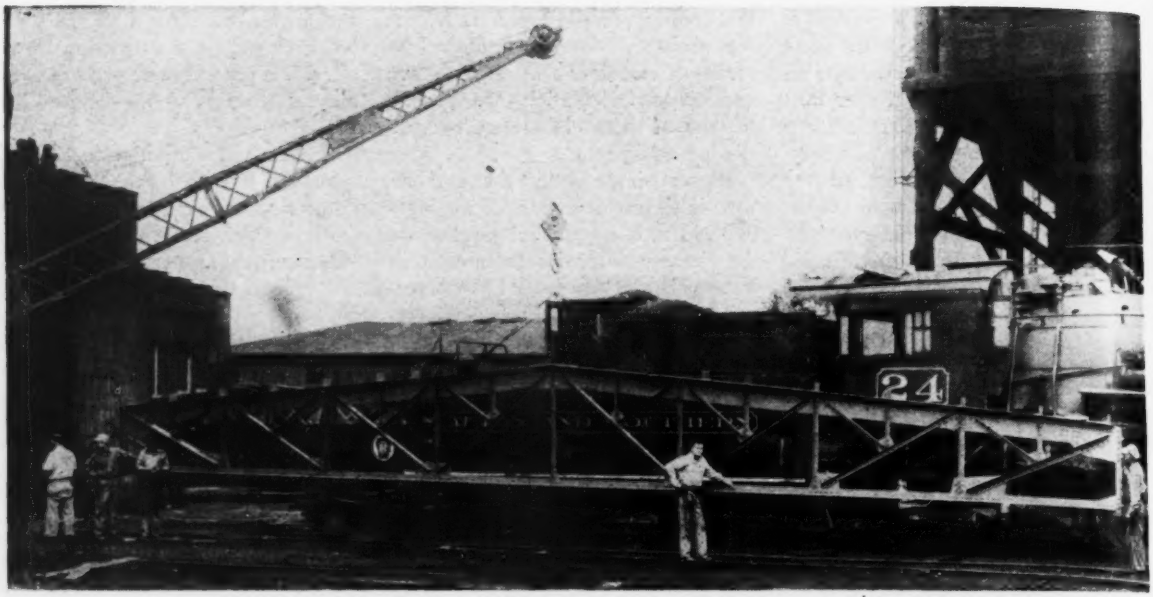


Fig. 1. Aluminum trusses, spanning 57 ft. and weighing 1,805 lbs., were used to replace badly corroded steel trusses.

Aluminum Roof Trusses for an Enginehouse

***Contents in Brief**—Structural steel roof trusses, corroded to the point of failure by locomotive gases, were replaced by all-aluminum, shop-fabricated trusses in the Alton & Southern R. R. enginehouse at East St. Louis, Ill. To retard future corrosion, the new trusses received one shop coat of zinc chromate paint and two field coats of aluminum.*

"Operation Imperative" might well be termed the decision of the Alton & Southern R.R. when, in 1945, it decided to replace in its East St. Louis enginehouse four 57-ft. span, structural steel roof trusses that had become so badly corroded from sulphurous locomotive gases as to threaten their collapse.

The trusses in question had been erected in 1912 and had been subjected to progressive corrosion since 1930 when the enginehouse was activated as a major locomotive service shop, with as many as 34 engine inspection and minor repair jobs being made per day.

The urgency of replacement of the old trusses is clearly indicated in the engineer's detailed inspection report made just prior to the decision to install new trusses. Said the report, "In their present condition, they [the steel trusses] will not sustain a heavy snow load without excessive strain or possible fracture, commanding that they be given immediate attention."

Top chords, subjected to the most severe accumulation of stack fumes, showed a reduction of 48 to 80 percent of the original cross-section of the members. Bottom chords had been reduced from 17 to 38 percent in net area and secondary web members had been reduced up to 68 percent of their original sections.

In the most seriously corroded truss it was found that 42 percent of the main web members had been reduced from 12 to 29 percent in cross-section; 36 percent showed a reduction of 37 to 55 percent, and 14 percent of the members had been reduced from 67 to 80 percent of the original cross-sectional area.

These reductions in cross-sectional area, while spectacular in amount, did not present a true measure of the load-carrying capacity of the trusses, since the original designs contained some large factors of safety for certain members.

A truer measure of strength was secured by calculating the actual working stresses based on available net sections of the corroded members and actual dead loads including provisions for a new roof, replacement of the old monitor with a combination skylight and ventilator, and new fire-resistant smoke-jacks. A snow load of 30 lb. per sq. ft. also was included in these design computations.

Actual stresses exceeded allowable

Results of these investigations and computations showed a maximum compression of 22,600 psi. in the top chord where the allowable stress was 16,700 psi. Maximum tension in web members was 34,000 psi., as compared with an allowable stress of 16,000 psi. Vertical truss members showed a maximum compression of 22,500 psi. as against an allowable stress of 15,900 psi. The bottom chords were not seriously overstressed —18,000 psi. compared with 16,000 psi., allowable. This was due chiefly

to relatively little accumulation of corrosive gases at the plane of the bottom chord. It is significant that the horizontal legs of the top chord angles and the outstanding legs of the web members suffered the greatest corrosion.

Of the two other exposed roof trusses in this particular section of the enginehouse, one was so far removed from locomotive gases as to be little affected by them. The other required some strengthening but not replacement in its entirety.

Although aluminum was the first choice of the railroad company in replacing the old trusses, its scarcity at that time resulted in designs being made for the use of structural steel. Fortunately, before the contract was awarded, structural aluminum shapes became available for a short period with the result that aluminum alloy, Alcoa 61 S-T was substituted for structural steel without redesigning the trusses other than to see that unit stresses were not excessive. These were based on an allowable 16,000 psi. in tension and reduced allowable compressive stresses for the aluminum alloy, which has a modulus of elasticity of 10,300,000 psi. instead of 29,000,000 psi., which is commonly used in structural steel design.

The greatest variation in cross section in this analysis occurred in the top chord. If made of structural steel, this member would have required two 4x4x$\frac{3}{8}$-in. angles and one 12x$\frac{1}{4}$-in. web plate. Using allowable compressive stresses for aluminum, the top-chord section was required to be made up of two 5x3$\frac{1}{2}$x$\frac{7}{16}$-in. angles and one 12x$\frac{3}{8}$-in. web plate.

No cost comparison is available between the aluminum trusses as erected and structural steel trusses as originally designed. However, total weight of one aluminum truss is 1,805 lb. while the computed weight of a steel truss of equal strength would be 4,255 lb.—a ratio of 1 to 2.36.

Trusses were shop-fabricated

Each of the four new aluminum trusses was fabricated complete in the shop, shipped to the enginehouse and erected in place with a locomotive crane. All rivets were aluminum alloy Alcoa 53S-T61. Shop rivets were cold-driven, but field rivets were heated to a controlled temperature of 960 to 1,050 deg. F. in a molten babbit bath.

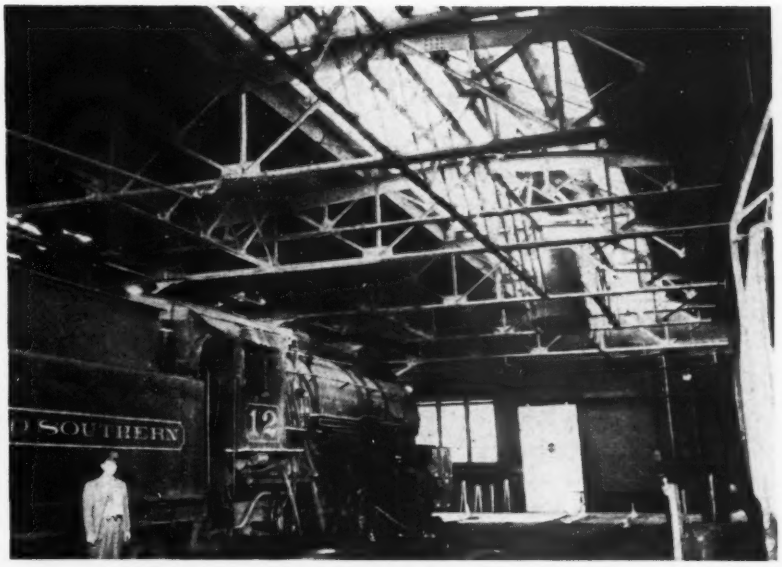


Fig. 2. New trusses support large skylight and fire-resistant smoke-jacks. Deep web plate of top chord eliminated gusset plates.

In erecting the new trusses, the old timber roof, which subsequently was replaced with a 20-year bonded, built-up roofing on 2x6-in. yellow pine, was shored up on movable pipe scaffold on each side of an old truss to be removed. The old truss then was cut loose from its supporting steel columns, removed, and the new truss erected in place.

New wind bracing included tie-rods in the plane of the top chords and trussed-framing connecting top and bottom chords at the center line of the roof. All wind bracing was aluminum, as were the angle struts between adjacent trusses to support the six new smoke-jacks installed beneath the trusses.

In addition to installing a new roof over the section of enginehouse containing the new trusses, the old monitor originally installed along the center line of roof was replaced with a new skylight 14 ft. wide and 112 ft. long. The skylight is of corrugated wire-glass sheets, fastened to timber purlins that are supported on timber-framed trusses carried by the roof trusses. It has a continuous 18-in. ventilator topped with a cover made of one-third segments of 36-in. dia. asbestos-cement pipe. The new fire resistant smoke-jacks, located in two sets of three each, directly above the three lines of railroad track in the enginehouse also are of asbestos-cement.

Fig. 3. Plates and angles of old trusses were corroded to paper thinness by locomotive gases. Note comparison with ⅜-in. thick aluminum angle for new trusses.

Engineers and contractors

Design and erection of the aluminum trusses and construction of the new roof were under the direct supervision of Raymond G. Brichler, assistant chief engineer, reporting to W. J. Nuebling, chief engineer of the Alton & Southern R.R. E. B. Hardwig was field engineer for the railroad.

The Aluminum Company of America, Pittsburgh, Pa., assisted in the design and furnished the aluminum trusses, which were fabricated by the Stupp Brothers Bridge & Iron Co., St. Louis, Mo. Paul T. King was construction superintendent for the Fruin-Colnan Contracting Co., St. Louis, Mo., general contractors for the work.

Electrical Stabilization of Soil

Editor's Note: *The following abstracts of two Russian papers were made by V. P. Sokoloff of the U. S. Geological Survey, as a by-product of other investigations being carried out under the direction of E. B. Eckel. They are published here with permission of the Director, U. S. Geological Survey, in the belief that the methods described deserve attention and testing by American engineers interested in soil mechanics.*

APPLICATION of direct electrical current in stabilization of clayey soils appears to be a new process. The two Russian papers here abstracted deal with the engineering applications of this method.

The introductory paper in a symposium on stabilization of ground and rock published by the Academy of Sciences of USSR in 1941, compares the costs of various physical and chemical methods of stabilizing different kinds of soils and rocks. According to this estimate, the electrochemical method is among the cheapest, the cost being 10 to 50 roubles per cubic meter as compared with 50-200 roubles for the chemical or mechanical method (1 rouble equals about fifty cents). The method is said to be particularly applicable to heavy basic clays of low permeability—a most refractory and expensive type of soil for other methods of stabilization.

The original papers contain no citations of earlier work and have no summaries, except in Russian. They describe apparently early efforts made with relatively simple apparatus. The physico-chemical mechanism responsible for the reportedly striking improvement of the engineering characteristics of the soil, following the application of direct electrical current, is suggested rather than proved. The papers seem to be progress reports and further work is, in all probability, well under way.

Density and strength increased

The first of the two main papers was written by B. A. Rzhanitzin and is entitled (in Russian) Electrochemical Stabilization of Clayey Ground. (Conference on Stabilization of Ground and Rock, Reports Vol. 1, pp. 55-66, 1941, Academy of Sciences, USSR). It states that the density and bearing strength of clayey soils are increased significantly in consequence of passage of electrical current through an otherwise undisturbed soil mass. The best field results were obtained at 30 to 200 kwh. at 100 to 22 volts (direct-current) per meter at not over 20 ampere per square meter. Distance between copper cathodes and aluminum anodes was between 0.5 and 1 m. There was no appreciable heating of the ground.

Changes produced in soils

Electro-osmosis of water, substitution of aluminum for other replaceable bases, and formation of aluminum and iron gels are believed to be responsible for the stabilization. Stabilized clays were kept immersed in water for two and one-half years without any visible sign of loosening. Swelling in gelatine was diminished markedly following the passage of current.

Some clays are more easily stabilized than others. For example, a clay with a plasticity index of 15.3, porosity of 35.4 and cation exchange capacity of 24.0 was stabilized entirely in 50 hours. Another clay (plasticity index 26.1, porosity 31.0, cation exchange capacity 40.3) was only partially stabilized in proximity of the electrodes. A third clay (plasticity index 3.2) required 200 hours under comparable conditions.

Increase in density is first observed in the vicinity of the anode and there is a decrease in density, during the first few hours, near the cathode. Later on, the ground near the cathode also gains in density. The ground roughly equidistant from the electrodes is the last to undergo the compaction by the current. A partial drying of the ground accompanies stabilization. In a cited case, moisture was reduced, roughly, from 53 to 20 percent.

The method is applicable in deep excavation of unstable floating wet clays and in rapid and cheap stabilization of bridge supports. Electrically stabilized clay forms a compact solid pediment which prevents sinking of the bridge supports into waterlogged clayey ground. Wooden bridge supports can be made into electrodes by mechanical attachment of copper and aluminum plates. Maximum stabilization was observed at about 1.25 wh. per square centimenter of electrode surface. Further application of current caused excessive compaction of the pediment and loosening of the supports. Addition of electrolytes ($CaCl_2$, NaCl) was helpful for clays of low exchange capacity which could not be stabilized by current alone.

Effect of frost reduced

The effect of electrochemical treatment as a means for reducing the heaving of clay soils was discussed in the second paper (Electrochemical Stabilization of Clayey Ground to Control Heave in Railroad Transport, by D. I. Solntzev and B. S. Borkov. Conference on Stabilization of Ground and Rock, Reports Vol. 1, pp. 67-79, 1941, Academy of Sciences, USSR).

Plasticity, shrinkage, expansion, and frost heave were minimized in several clayey soils, following passage of electric current. These changes are favored by addition of $CaCl_2$ before the treatment. NaCl must not be used as it causes much swelling and a drop in the bearing strength in proximity to the cathode. A direct-current generator, capable of yielding 20-30 kw. at 120-140 v. pressure is recommended for stabilization in the field. Iron anodes may be used in place of aluminum, with copper cathodes.

Laboratory tests were conducted

with soils of glacial origin containing much colloidal clay. Both calcium and sodium clays were tested. Roughly 50 percent dehydration of the soil followed the passage of current. Liquid limit and plasticity index were lowered strikingly by the treatment; bearing strength, as measured by penetrometer, increased at the electrodes significantly. Ground temperature was not affected by 2.3 milliamperes per square centimeter of current but was increased somewhat by higher current densities.

Filtration coefficients, lowered by the application of small amounts of power, tended to increase following additional power expenditure. The cathode zone, however, did not recover its original filtration coefficient, whereas the anode zone acquired a higher filtration coefficient than the original following a three-fold increase in the power.

This difference in behaviour of the two zones is explained by the different kinds of microstructure developing in consequence of coagulation and cementation in the cathode zone. Stability of the cathode zone in the presence of water is very high and is not influenced significantly by the density of current. Stability of the anode zone, on the other hand, is comparable to that of the cathode zone after 2, 6, or 7 milliamperes per square centimeter, but is much lower at the intermediate and at the higher current densities.

Less heaving of clay soil

Migration of moisture in frozen ground is impeded in consequence of the electrical treatment, and the frost heave is diminished. Treatment by combination of NaCl and direct current caused a more than ten-fold diminution of the frost heave; an equal weight of $CaCl_2$ was somewhat less effective. Swelling of the NaCl-treated ground *before* the freezing was so high, in comparison with the $CaCl_2$-treated ground and the untreated ground, as to make the application of NaCl inadvisable in the field. The marked decreases in frost heave, plasticity index, and swelling brought about by the electrochemical treatment appear to be due to an irreversible coagulation of the colloids.

Field experiments on ground normally subject to frost heave were conducted with checker-board system copper rods (cathodes) and perforated iron pipes (anodes). Improvement in stability, bearing strength, and resistance to frost heave was comparable to the results obtained in the laboratory. Despite the excellent results of the treatment with 0.2 percent NaCl and direct current in preventing frost heave, this treatment was found to have caused instability of the cathode zone. Substitution of Ca for Na, while somewhat less effective in preventing frost heave, resulted in a satisfactory and lasting stabilization of the entire ground.

Illinois Industries Push Pollution Abatement Program

Progress in stream pollution abatement is being made by Illinois' industry. As a result of a series of studies and conferences with state officials two industries have taken action to abate contamination in the Illinois River.

Dr. Roland R. Cross, state director of public health and chairman of the Illinois Sanitary Water Board, recently announced that the Commercial Solvents Corporation and the American Distilling Company are taking steps to correct direct discharge of distillation residues into the river.

C. W. Klassen, the board's technical secretary, explained that CSC wastes, which result from the manufacture of industrial solvents from corn and molasses, are now being converted into a valuable livestock feed supplement. It is calculated that the recovery plant will remove pollutional material from the river equivalent to that domestic sewage from a city of approximately 350,000 persons.

This installation is the final step in the stream pollution-abatement program of the Commercial Solvents Corporation and will effect complete recovery of all solids contained in its distillation residues when the plant is at capacity operation. It is estimated that twelve months will be required to complete the installation of the proposed equipment.

In 1938 the corporation installed a recovery plant for a portion of its process which at that time reduced the pollutional discharge by an amount equivalent to the domestic sewage from 138,000 persons.

The installation of this plant is the result of extended research on the part of Commercial Solvents Corporation extending over a period of several years, cooperating with the engineers of the Greater Peoria Sanitary District and the state board.

The American Distilling Company's proposed plant will recover pollutional material equivalent to domestic sewage from a city of about 575,000 persons. Further, it will salvage valuable livestock feed from the wastes.

This plant is approaching final construction stages and should be placed in operation within a few months.

For a number of years the American Distilling Company has operated a feed recovery plant for a portion of its process wastes. This unit reduced the pollutional load by an amount equivalent to the domestic sewage from 120,000 persons. The new installation is the final increment in the industry's program.

In commenting upon the program of the sanitary water board, Dr. Cross said, "We believe it is much more desirable to recover a by-product from waste material where such is possible than to merely treat the wastes and lose the benefits to be derived from the by-product. While abatement of stream pollution is the board's primary concern, this twofold benefit of abating pollution through recovering a valuable by-product is a definite part of the board's program and action by this large corporation is illustrative of the excellent cooperation being received from Illinois' industry."

The Illinois sanitary water board is composed of L. E. Osborne, state director of conservation, W. A. Rosenfield, director of public works and buildings, Arnold P. Benson, director of agriculture, R. W. Gothard, representing industry, and Dr. Cross.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Pipe Floated Through Conduit

Experience gained in Seabee service came in handy when San Diego (Calif.) Gas & Electric Co. Engineer C. W. Capwell was faced with the problem of placing a 12-in. gas main under an existing highway.

Under California's highway specifications, pipes must be placed in protective conduits. Crossing the Sixth Ave. approach to Mission Valley Road was no exception. To get the 12-in. pipe into the conduit without damaging the wrapping became a major problem. Familiar with the "impossibilities" handled by his Seabee outfit overseas, Capwell came up with the idea of digging a trench in front of the conduit and floating the pipe into position.

When the conduit was laid, a messenger wire was placed inside. A trench, slightly longer than the 300-ft. section of pipe, was excavated in front of the conduit. After both ends had been sealed, the pipe was lowered into the ditch. The tow cable was then drawn through the conduit by means of the messenger wire. Finally, water was turned into the trench until the pipe floated. Two men guided the pipe into the conduit as two other laborers at the opposite end pulled the pipe through.

In the manner, the gas main was brought quickly into location without breaking the protective coating.

San Diego Gas & Electric Co. photo

Floating a 300-ft. section of 12-in. gas main through a highway-crossing conduit solved the problem of protecting the pipe-coating during insertion. The dotted line indicates the pipe alignment. In the left-hand inset, the floating main is being guided into the larger pipe; in the righthand inset, the pipe is being pulled through by means of a cable.

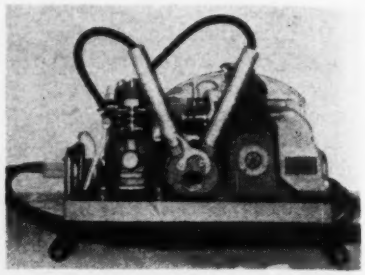
Ice Plug Aids Pipe Repairs

Introduction of an ice plug in a pipe line without valves between the water source and a leak permits a continuance of service in adjoining services and speeds repair work.

Appearing recently in England a portable machine consisting of a 1 hp. gasoline engine, a small compressor, and a pipe-gripping device fitted with tubes and container to bring a freezing solution into contact with the pipe provides the means for creating a localized "ice block" in pipes up to 1½ in. dia.

The cooling liquid, methyl-chloride is liquefied by the compressor and forced through two flexible, twin-bore, metallic hoses into dual expansion chambers of the pipe attachement. The gas then returns through similar flexible hoses to the compressor for liquefaction and recirculation.

The two-sector freezing contact is locked around the pipe by means of hinged, hook clips on each side of the machine. Split copper brushes provide accommodation to various pipe sizes.



The small compressor driven by a 1 hp. gasoline engine supplies liquefied methyl-chloride to the pipe contact where expansion into a gas lowers the temperature until a temporary "ice plug" is formed in the pipe.

Two auxiliary tools, "a controlled drip" and "a pipe closer" are required for the repair of lead or copper tubes, but only the controlled drip tool is needed in the case of steel or iron pipes.

This device has been successfully in making repairs to outside laterals. It is particularly convenient for use in industrial establishments where process work is in operation and an interruption of water supply would cause considerable loss.—F. G. BAILEY, *Surrey, England.*

Dumpy Level Adjusted Quickly

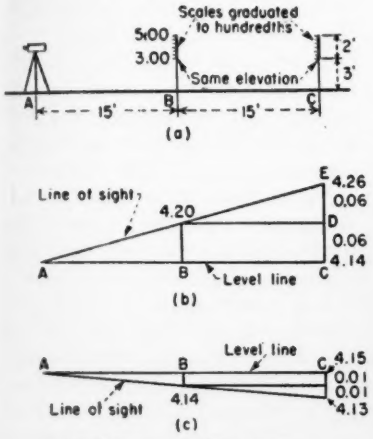
The so-called "peg" adjustment is easy to perform, but it takes too much time. The following method, which has been used during several years at Kung Shang University, Tientsin. China, has the advantage that the level may be adjusted completely from a single station point.

Two short identical scales are fixed on corridor walls. Graduated from 3.00 to 5.00 ft., the scales are set so that corresponding points of the two scales are exactly in the same horizontal plane (See diagram (a) in the accompanying drawing).

The instrument is set on its tripod, or preferably on a concrete support at point A. The scales are located at points B and C (AB = BC). After adjustment of bubble, readings on the two scales should be the same. If not, the cross-hair is out of adjustment. Error increases with distance. If scale C reads higher than scale B, the line of sight slopes upwards. If scale C reads lower than scale B, the line of sight declines.

Example: 1st trial (b)—Far reading: 4.26 ft. Near: 4.20 ft. Line of sight upwards. From similar triangles, as AB = BC. ED = DC = 0.06 ft. The cross-hair should be adjusted to read 4.20 − (4.26 − 4.20) = 4.14 ft.

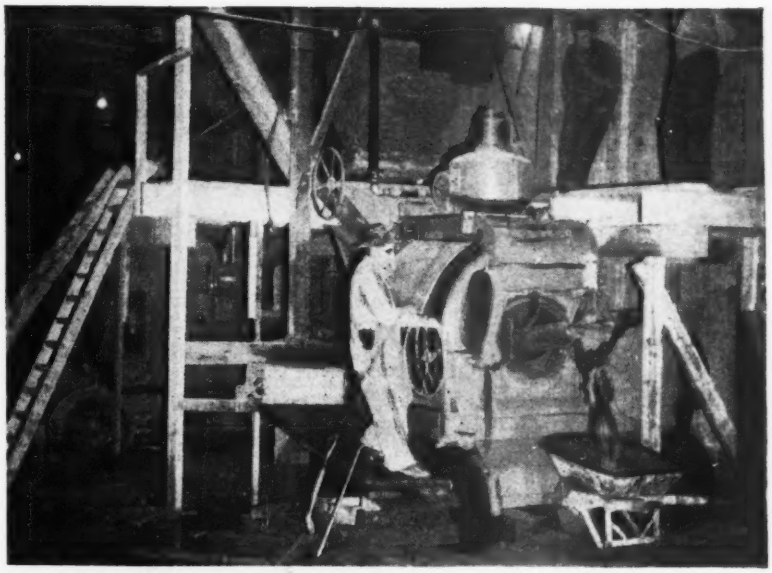
2nd trial (c)—Usually a slight error will still remain. Near reading: 4.14 ft. Far: 4.13 ft. The line of sight is downwards. The cross-hair should be adjusted to read 4.14 + (4.14 − 4.13) = 4.15 ft.



Scales on corridor walls

Distances AB and BC should be equal. AB should be somewhat larger than the minimum sighting distance of instrument. Fifteen feet will be enough for most instruments. Using this distance, the results will usually be more accurate than those obtained in the field with distances of 100 ft. or more, as indoor adjustments may be performed under better conditions.

Relative position of the scales should be checked once a year, because of possible settlement of the building. The method may be used for peg adjustment of transits or for final check of wye-level adjustment. —H. Pollet, *Dean of Engineering, Kung Shang University, Tientsin, China.*



AGGREGATES FLOW BY GRAVITY TO WEIGHING BATCHER

Mixers in sub-basement are fed by gravity with aggregates dumped by trucks into improvised hoppers in the basement that flow by gravity to weighing batcher on monorail under the sub-basement ceiling. Batcher moves to receive sand, gravel and cement and then to discharge to either a concrete or mortar mixer on the sub-basement floor. Mixers are in use by Geo. A. Fuller Co. on 16-story hospital at Hartford, Conn.

(U. S. Bureau of Reclamation photo)

REINFORCING BARS LOCATED IN CONCRETE

To locate reinforcing bars embedded in concrete, an instrument consisting of an electromagnet, an electronic amplifier, and earphones has been developed in the Denver laboratories of the U. S. Bureau of Reclamation. When diamond drills and the reinforcing grid were damaged in sinking grout holes through 2-ft. thick lining of the outlet tunnel of the Anderson Ranch Dam near Boise, Idaho, the project engineer appealed for help. Engineers C. R. Daum and L. T. Cleaner then built this device which locates bars within one inch by observing an increased intensity of sound.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Flood Control Appropriations

Sir: The article "Army Engineers Complete Dredged Cutoff to Control Meander of Arkansas River", by Austin B. Smith (*ENR* April 3, 1947 vol. p. 508) gives a very interesting and informative description of the 1946 cutoff at Hopedale.

The Arkansas River is a typical alluvial stream and students of such rivers have come to the conclusion that the length and general meander pattern (i.e. width of meander belt and general characteristics of bends and crossings) tend to remain about the same if undisturbed. These factors are determined by the peculiar characteristics of the stream itself which vary very little through the years. They are the general slope of the valley, the character of the bed load, the materials of which the bed is composed, and the characteristics of the discharge hydrograph. Bank caving, bar building, and cutoffs are normal in such a river, the meander pattern is continually shifting but one action balances the other so as to keep the length and general pattern characteristics within surprisingly close agreement.

The construction and maintenance of levees upsets this natural regimen to some extent. No longer does the river build itself natural levees as it extends its bends out into the back swamps. Cutoffs upset the regimen much more drastically. But in order to render the fertile alluvial lands habitable we must resign ourselves to some fighting of the river. It should be realized fully, however, that once we have entered the battle that it is a continuous fight. The only alternative would be complete control by reservoirs, soil conservation measures, and bank stabilization to trim the river down to our size and then to confine it to a fixed channel. That alternative is the dream of all who live along the banks of alluvial rivers, but seems to be probable of early accomplishment on a very few of which the Arkansas it not one.

With Congress back in the old groove of paying all of its attention to balancing its bank account without regard for the deterioration of its capital assets the hope of adequate measures for control is even dimmer now than it has been. The recommendations of the Bureau of the Budget for work on the Mississippi River and its tributaries for fiscal year 1948 is wholly inadequate for the bare necessities of a continued fight along the unsatisfactory lines which have been held in the past, and it is rumored very plausibly that even this poor sum will be cut by Congress. We do not believe that in the event of an impending disaster Congress will sit by and let us drown here in the valley. But by short-sighted appropriations they may let us come close to it, and they may force such restrictions on the ordinary operations of the Army Engineers that planning and mobilization for our defense will be very expensive if not too late.

When the budget of the Army Engineers is cut as drastically as seems to be the program for this year the engineering studies and researches for proper planning of work will have to be cut to the bone, and the small available funds conserved to be used in attacking emergencies after they have arisen. Compilation of records will have to be cut to the point that those collected will be greatly lessened in value. Personnel will have to be transferred.

Politicians seem to be unable to understand these facts of organization and economics which are so apparent to engineers. The proper development of our country will never be obtained until its engineers exercise themselves to the extent of insistently pointing out to the Congress, whether or not the occasion patently presents itself, the evils of its ways in regards to matters concerning which engineers alone are competent to bear witness.

The combined voice of those recognized as authorities raised in constructive criticism of irrational procedure by Congress in regards to public works of this character would undoubtedly have a great deal of weight. By making it our business to give Congress the benefit of our opinions on matters about which we have special knowledge engineers can prove their patriotism in times of peace.

LEO M. ODOM
Louisiana Department of Public Works
Baton Rouge, La.

Lyon's Wrecked Bridges

Sir: I noted with a great deal of interest the article "Lyon Rebuilds Its Many Wrecked Bridges" (*ENR* Jan. 9, 1947, vol. p. 34), because one of my first activities while on military occupation duty in Southern France resulted from an order from G5 of the 6th Army Group to meet with French officials and attempt to expedite the rebuilding of Lyon's bridges. The city was completely devoid of the materials, supplies, transportation and labor necessary to reestablish the bridges, and unfortunately not much in the way of American supplies and equipment was available at that time.

My problem centered on arrangements for temporary repairs that would permit a flow of traffic sufficient to maintain some semblance of orderly return of the city to a somewhat normal life. The final outcome was that the French themselves were able to build pile bent trestles and other devices of a temporary nature.

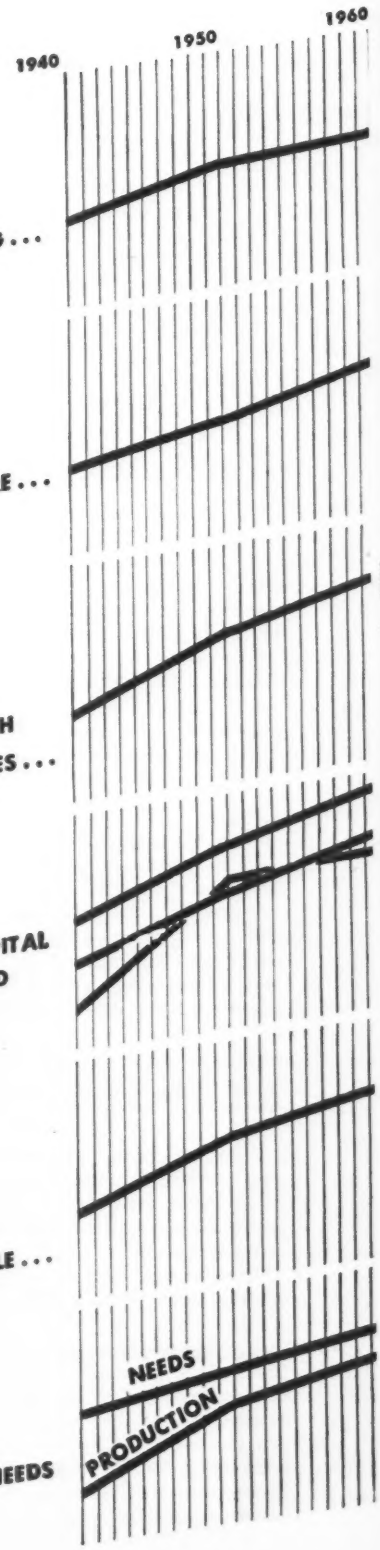
From your article it is easy to appreciate the heavy demand that was placed upon the French officials, which taxed their ingenuity in designing emergency measures of repair, the details of which we had little to do with. My personal reaction is that a great compliment should be paid the French engineers for their success in salvaging and reestablishing those bridges.

I was fortunate enough to be detailed as Chief Civil Affairs Officer for the Lyon region and remained on that post for about seven months, consequently had the opportunity of watching the progress on these structures at first hand.

SEDRIC A. PAYETTE
Manager
Public Utility District No. 1 of Clallam County, Port Angeles, Wash.

1950-1960

The Twentieth Century Fund, a privately-endowed research foundation, has just completed a monumental 875-page work called "America's Needs and Resources." In it is presented a detailed preview of what economic life in the U. S. A. during the 1950-60 decade will be like if we succeed in maintaining high-level employment. From the findings of the Twentieth Century Fund survey, the McGraw-Hill Department of Economics has prepared this synopsis, which highlights points of interest to readers of this magazine.


1940
1950
1960
MORE PEOPLE WORKING . . .
EACH PRODUCING MORE . . .
CAN TURN OUT ENOUGH GOODS AND SERVICES . . .
FOR CONSUMERS, CAPITAL INVESTMENT AND GOVERNMENT
WITH THE RESOURCES AVAILABLE . . .
TO MEET ALMOST ALL OUR NEEDS
NEEDS
PRODUCTION

POPULATION

A nation's wealth depends more than anything else on the size and vigor of its population. Much of the increase in U. S. production during the past hundred years is a result of a rapid growth in population. This growth supplied manpower for farms and factories and provided an expanding market for consumer goods and services.

MORE PEOPLE WORKING . . .

Growth was the outstanding fact about population before 1930. The birth rate was almost double the death rate and there was a heavy flow of immigrants. Between 1900 and 1930, the population increase averaged 15 million each decade. Immigration contributed a third of the increase.

But this trend was checked by the depression 30's which stemmed the flood of immigrants and cut the birth rate by forcing postponement of many marriages. As a result, fewer than 9 million persons were added to the population between 1930 and 1940. This was an important factor in prolonging the depression because it slowed the growth of consumer markets.

WARTIME MARRIAGE BOOM

War and postwar conditions have brought a boom in marriages. They have exceeded normal by more than 1,500,000 since 1940. There will be more newly-married couples in 1950 than ever before and the birth rate may be roughly 10% higher than in the early 1930's. So the 20th Century Fund looks for an increase of 12 million in total population between 1940 and 1950 and a further increase of 10 million in the 1950's.

This will mean a faster-growing market for homes, autos, food, clothing, and other consumer items than we had in the 1930's. It will mean crowded schools and more people seeking jobs.

There are four major population trends which will affect markets in the 1950's:

1. The number of families will continue to increase more rapidly than the number of people as families grow smaller. This is significant because the market for housing, appliances, and many other things depends more on the number of families than on the number of people.

2. Our population will be getting older. But it will not be getting less productive because the proportion of the population between the ages of 20 and 60 will be higher than in past decades. Still, the most striking increase will take place in the number of people over 60—from 14 million in 1940 to more than 20 million in 1960. This will bring greater demand for medical services and social security. An important cause of this trend is our success in controlling communicable disease. The following table shows how the death rate from selected causes has changed since 1900.

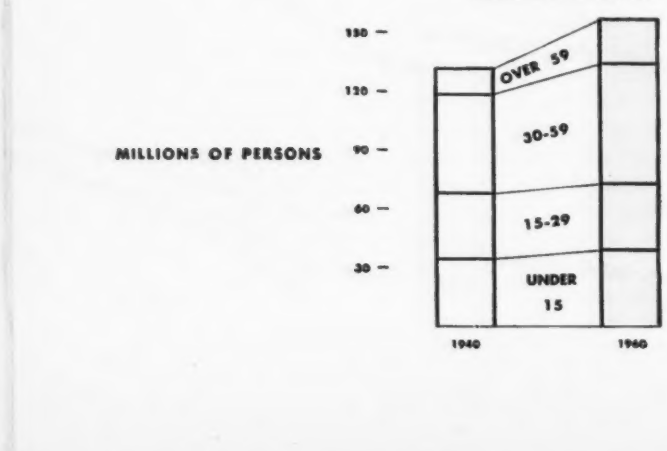
Death Rate Per 100,000 Persons

	1942	*1900*
Diseases of heart	295	137
Cancer and other malignant tumors	122	64
Influenza	56	202
Tuberculosis	43	194
Diarrhea and enteritis	9	143
Whooping cough	2	12
Diphtheria	1	40
Measles	1	13
Typhoid and paratyphoid fever	0.5	31
Scarlet fever	0.3	10
Other	505.2	873
	1035.0	1719

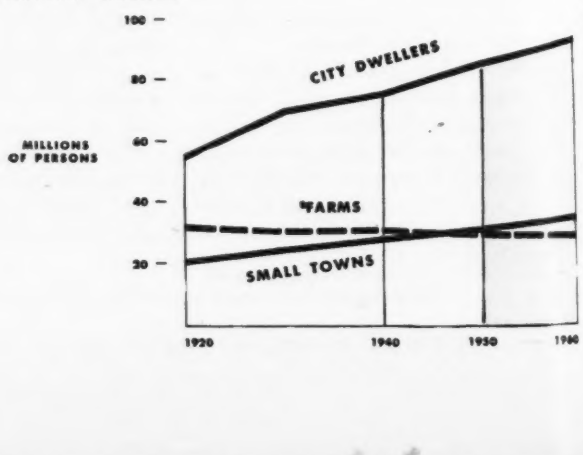
TWICE AS MANY PEOPLE

BUT THREE TIMES AS MANY FAMILIES

MORE OLDER PEOPLE

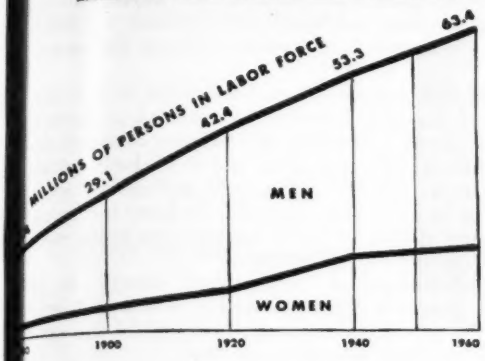


MORE CITY DWELLERS

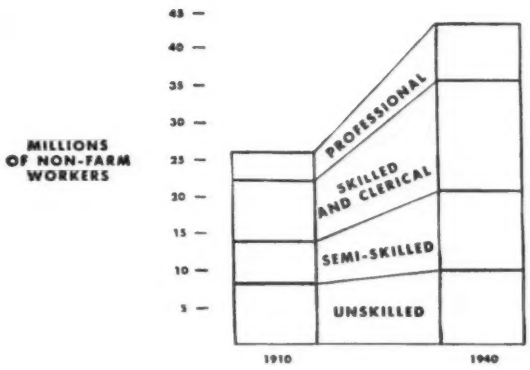


ANATOMY OF THE LABOR FORCE

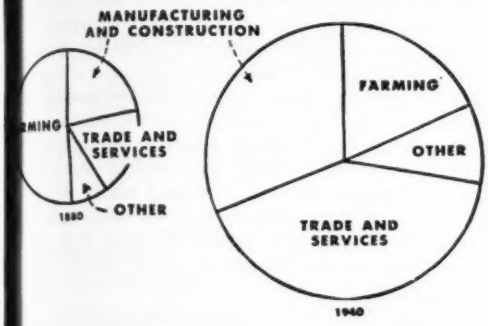
MORE AND MORE WOMEN ARE SEEKING JOBS



THE LABOR FORCE IS GROWING MORE SKILLED



FARMING IS GIVING WAY TO OTHER OCCUPATIONS



3. The population will continue to become more urbanized. Small and medium-sized cities will grow faster than the largest cities. The general westward migration which was accelerated by the war will continue.

4. Our people will keep on getting more homogeneous. There has been almost no immigration since 1929, so the number of immigrants who have been in the country for less than 20 years will make up less than one percent of the population in 1950 as against 10% in 1930.

An even more important factor in making the population all of a kind has been the growth of universal education. The proportion of children 14-17 years old attending high school doubled between 1920 and 1936. The rise of the radio, movies, and national magazines has also levelled us out. These developments not only raise the general educational level of the nation but also tend to standardize the public's tastes and attitudes.

LABOR FORCE

The volume of goods and services produced by 145 million persons in 1950 and 155 million in 1960 will depend on what share of the population is in the labor market and the amount of work those employed actually do. The proportion of the population in the labor force has shown little change in the past few decades. So the 20th Century Fund assumes that the relationship between labor force and population will be about the same in 1950 and 1960 as it was just before the war. On this basis 60 million people will be in the labor market in 1950 and 63.4 million ten years later.

As you can see from the charts, however, there will be several important changes in the composition of the labor force. More women will be working. In 1870 only one out of every eight worked. By 1940 the proportion had grown to one out of four, and evidently will go on rising.

However, the increase in the number of women working will just about be offset by earlier retirements and longer schooling. This explains why there is little change in the ratio of labor force to population.

UNEMPLOYMENT

The effectiveness of the labor force depends not only on its size but on how fully it is employed. We have never had full employment in the sense that everyone able and willing to work had a job at the same time. Even in good years unemployment has seldom averaged less than 5% of the working force because workers are always moving from job to job. And in 1932, nearly one-fourth of all workers were unable to find jobs.

For this reason, the 20th Century Fund assumes that, even with good business in the 1950s, unemployment will average 5% of the labor force. This works out to 3 million unemployed in 1950.

In addition, the Fund expects the long down-trend in average weekly hours to continue. A century ago, workers put in a 12 hour day for 6 days a week. By 1940 the average work-week had declined to 44 hours in non-agricultural jobs and 52 hours in agriculture. If this trend continues, the average in non-farm jobs will be down to 38 hours a week in 1960, and farmers will work 48 hours.

Adding all this up, and allowing for vacations, absenteeism, and sickness, the 20th Century Fund estimates that the U. S. will put in 121 billion man-hours of work in 1950 and 118 billion in 1960. This compares with 105 billion in 1940 and with 154 billion at the peak of the war effort. The quantity of goods and services that can be turned out with this amount of labor effort will depend on average output per man-hour, or productivity.

PRODUCTIVITY

The key to our future economic welfare is productivity. It is the five-fold increase in output per man-hour that has made it possible for us to work shorter hours and still enjoy a rising standard of living. This increase in productivity has been accomplished not by working harder but by constantly inventing better machinery to supplement human energy with mechanical power.

Of course, in any specific factory at any given time, productivity depends largely on the willingness and ability of labor and management. But over the years, the actual effort of the individual worker becomes much less important than the effort of the machine. The most energetic and skilled blacksmith of a century ago could not remotely approach the productivity of today's semi-skilled worker operating automatic power-driven equipment.

EACH PRODUCING MORE . . .

In 1860, the average worker turned out 33¢ (in 1944 dollars) worth of goods in an hour. By 1940, this had grown to $1.22. This sensational increase in productivity was due to the increased use of power-driven machines. In 1860, the average worker had the help of only half a horsepower of animal or mineral energy. In 1940, he had the use of 2.7 horsepower. To put it another way, if there had been no increase in the use of mechanical power since 1850, it would have taken 290 million workers to turn out the amount of goods and services actually produced at the peak of the war effort by only 63 million workers.

DO MACHINES KILL JOBS

Past history also shows that we need not fear the long run effects of the introduction of labor-saving machines. On the contrary, the only way we can improve the material welfare of everyone is to continue and even step up the rate at which we save labor by using machines.

Some people, it is true, are thrown out of work and a few of them may not be able to find other jobs easily. But mechanization more than compensates for "technological unemployment" by making it possible to produce more and better things for everyone—things that themselves create jobs. Development of the railroads and the automobile, for example, put a lot of canal boat and livery stable operators out of business. But it cut the cost of transportation and created many times more jobs than it eliminated.

The 20th Century Fund also points out that the most important reason that the technological revolution developed luxuriantly in the U. S. between 1850 and 1940 was that competitive enterprise provided a generally favorable climate. It is true that natural resources were plentiful and that the population was growing rapidly both in numbers and in skill. But what we had to a unique degree here was an atmosphere which favored risk-taking, fostered the vast capital investment necessary to harness and apply mechanical energy, and provided the incentives necessary to put capital and inventiveness to work.

No other economy has equalled ours in the ability to produce more and more with continually diminishing human effort. The test it now faces is whether it can eliminate the ups and downs in production and employment that have gone along with it. But an abundance of evidence indicates that we ran into trouble after 1929 not because we developed too many labor-saving machines but because we didn't adjust our economic mechanism to keep the process going.

The key importance of mechanization is indicated by the fact that the increase in national production since 1860 closely parallels the increase in use of mechanical power. Between 1860 and 1940, both volume of production and use of energy multiplied about 11 times. It is clear that, in order to keep our standard of living rising, we must continue to apply more and more power to production.

Chief advantage of mechanical energy is, of course, its low cost. Electric energy is now delivered for as little as a cent a horsepower, while the same amount of human energy costs $10.

And there are other important advantages. Mechanical energy can be delivered in greater concentrations than any other form. It is also more convenient, compact, mobile, and controllable. Consolidated Edison in New York delivers enough electricity in a day to do the work of 3 million draft horses.

These advantages are now so universally accepted that it's hard to realize how recently we left the horse and buggy era. At the turn of the century, animals and men provided more than half the energy used in production and transportation. It wasn't until World War I that trucks replaced horses in local hauling and tractors began to invade the farms. Here is how the use of mechanical energy has grown since 1850:

	Total Energy Output (Billions of Horsepower-Hours)	Percent Supplied by:		
		Mechanical Energy	Humans	Animals
1850	17.6	6	15	79
1860	25.2	7	14	79
1870	27.8	12	15	73
1880	39.9	17	14	69
1890	61.1	28	12	60
1900	82.9	38	10	52
1910	131.4	57	8	35
1920	197.4	73	6	21
1930	238.3	84	5	11
1940	289.4	90	4	6
1950	410.4	94	3	3
1960	489.8	96	2	2

PRODUCTIVITY IN THE FUTURE

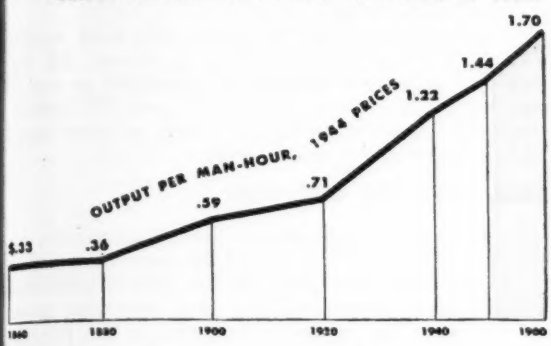
Any attempt to predict future developments in productivity is complicated by the fact that the changes do not occur at an even rate. Between 1850 and 1940 the average increase in output per man-hour was 18% per decade. But the changes varied all the way from 3% between 1870 and 1880 to 42% for the decade ending in 1940. There is, therefore, no simple way to extend past trends to obtain a foolproof figure for productivity at a future date.

For purposes of this study, however, the 20th Century Fund assumes that the average rate of increase since 1850 may be projected to estimate output per man-hour in 1950 and 1960. Thus, output per man-hour works out to $1.44 in 1950 and $1.70 in 1960 as against $1.22 in 1940 (all in 1944 dollars).

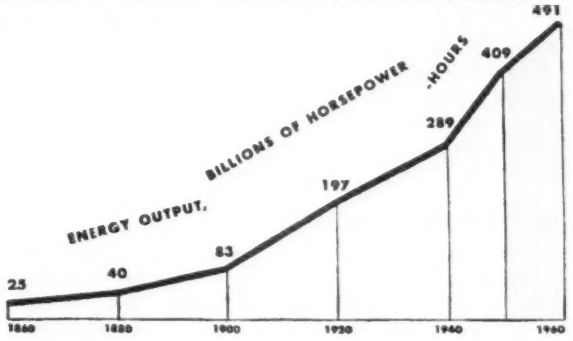
As the Fund points out, this is a critical assumption, and it is further complicated by the fact that there is a wider possibility of error in this estimate than in most of the others in the study. If, for example, it is assumed that productivity will increase at the pace set from 1920 to 1940 which averaged 36% per decade, then 1960 production would be about double the 1940 level instead of only 157% of it, as the 20th Century Fund estimates.

A CENTURY OF ECONOMIC PROGRESS 1860 – 1960

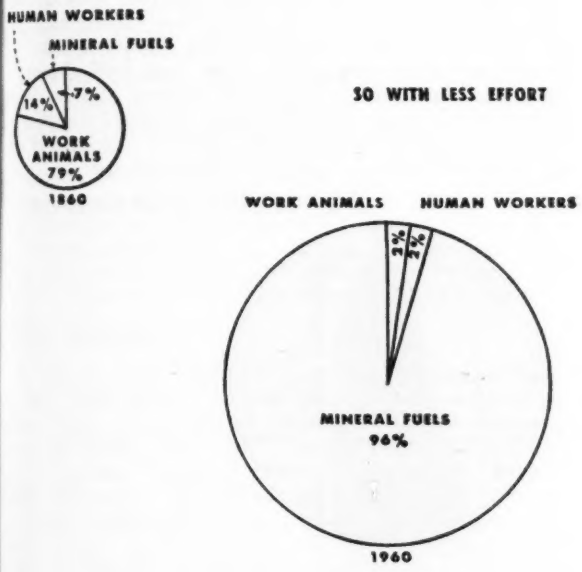
OUTPUT PER MAN-HOUR SHOULD BE 5 TIMES AS GREAT



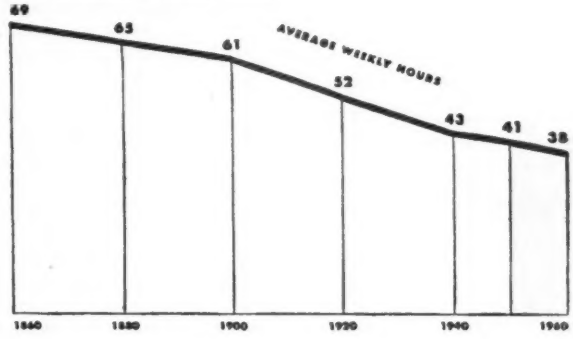
BECAUSE OF A STEADY GROWTH OF POWER AND MACHINES



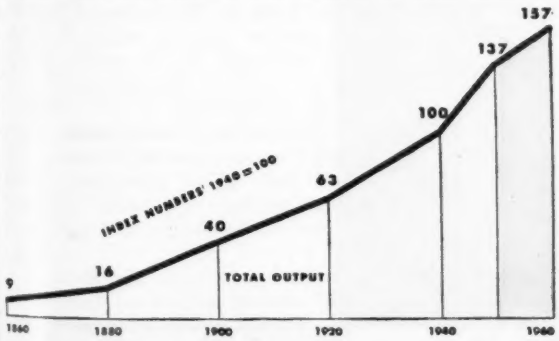
SO WITH LESS EFFORT



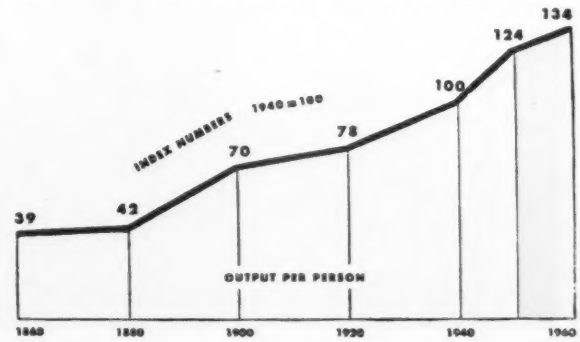
AND A SHORTER WORK WEEK



6 TIMES AS MANY WORKERS CAN PRODUCE 17 TIMES AS MUCH



AND PROVIDE 3½ TIMES AS MUCH OUTPUT FOR EACH PERSON



TOTAL NATIONAL OUTPUT

The potential volume of goods and services in 1950 and 1960 can be determined by simple arithmetic, using the assumptions outlined on the preceding pages. Of an estimated population of 145 million in 1950, about 60 million persons will be in the labor market and 57 million of them will have jobs if we succeed in keeping business activity at a high level.

This many people would work 121 billion man-hours. With output per man-hour estimated at $1.44 (in 1944 dollars) the total value of goods and services produced, or the gross national product, would come to $177 billion. Similar calculations yield a gross national product of $202 billion for 1960.

As the 20th Century Fund emphasizes, these estimates are neither a forecast of actual production nor an appraisal of maximum potential production. They are merely an attempt to show in dollars and cents what can be achieved with high-level employment.

HIGHER LIVING STANDARDS

Compared with any prewar year, a gross national product of $177 billion in 1950 and $202 billion in 1960 would represent a handsome gain. It would make possible a substantial rise in living standards. In 1950 we would produce a fifth more than in 1941.

CAN TURN OUT ENOUGH GOODS AND SERVICES . . .

However, the volume of goods and services turned out in 1950 would be only slightly higher than present production. This is because the number of persons at work today is 2 million above the estimated normal for 1950, and average weekly hours are higher than they will be then. Almost a million and a half of the emergency workers drawn into the labor force during the war are still at work and unemployment is lower than the figure assumed for 1950.

The estimates of 1950 and 1960 gross national product, as well as the figures for past years used in the chart, are expressed in 1944 prices. This is not a prediction that the price level will settle down to the 1944 level which would involve a drop of 18% in the cost of living and 26% in wholesale prices. It is merely a device to eliminate price fluctuations so that the figures will show only the actual changes in the physical volume of production.

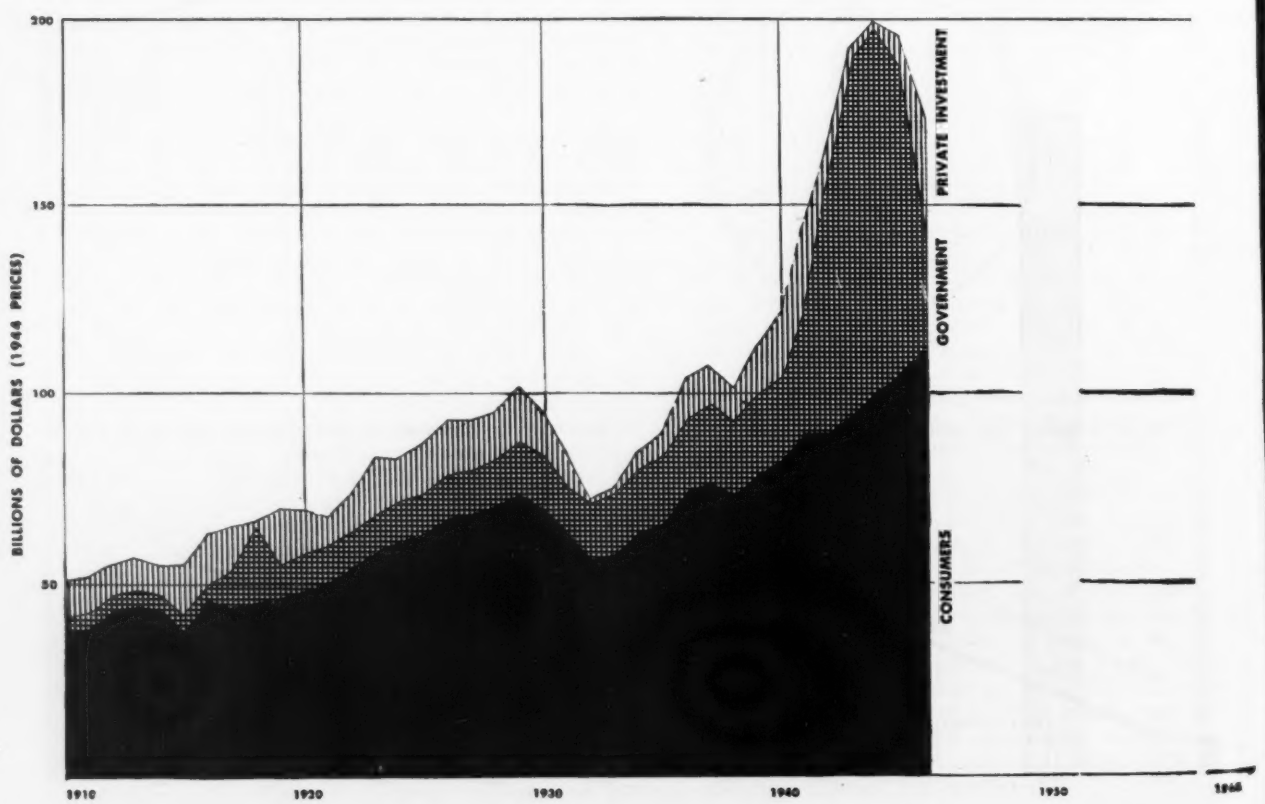
Gross national product measures the total market value of everything the nation produces. All the goods and services produced are absorbed in one of three ways: by consumer expenditures; by expenditures for investment in capital goods or inventories; or by government expenditures.

HIGHER TAXES, LESS INVESTMENT

The division of total output among consumers, investment, and government will be somewhat different in 1950 and 1960 than in the past. About two-thirds of total output will go into consumer goods and services. This is about the same as the proportion in prewar years.

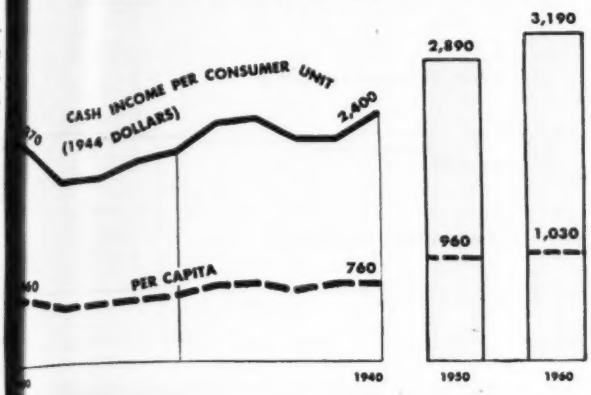
Government's share will continue to grow, however. It rose from 11% of total output in 1929 to 17% in 1940. At the peak of the war effort, half of all production went to Uncle Sam. Government expenditures have dropped to less than half the war peak and they will continue to decline slowly. But government's share will still run to around 20% in the 1950's. On the other hand, the ratio of investment to total output shows a slight long term decline.

HOW TOTAL OUTPUT IS DISTRIBUTED

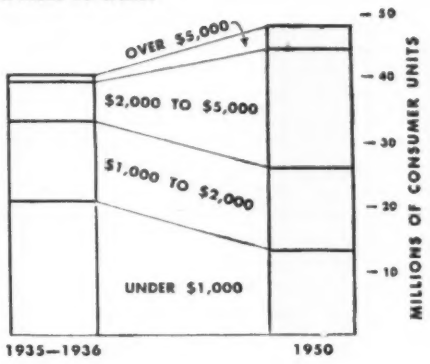


MORE CONSUMER PURCHASING POWER

CONSUMERS WILL BE ABLE TO BUY 50% MORE THAN IN 1930'S



EVERY OTHER FAMILY... INSTEAD OF EVERY SIXTH FAMILY... WILL HAVE $2,000 OR MORE TO SPEND.



CONSUMER INCOME

U. S. business can look forward to a 1950 consumer market twice as large as in the worst year of the depression, half again as large as in 1929, and one-fifth larger than in 1941. That is the major conclusion of the 20th Century Fund's analysis of consumer purchasing power. Here are the steps by which it arrives at that conclusion:

1. With gross national product at $177 billion in 1950, past experience indicates that income payments to individuals would run to $138 billion.

2. Income tax rates are assumed to equal the 1942 schedules, so individuals would pay $11 billion in taxes (as against $19 billion in 1946).

3. Savings are estimated at $12 billion, or about 9% of income after taxes.

4. Subtracting taxes and savings, consumer purchases of goods and services would total $116 billion.

LOWER SAVINGS

Many experts would criticize the assumption that savings will amount to only 9% of income. Some of them look for a ratio as high as 20% in prosperous postwar years. The 20th Century Fund justifies the use of a low figure on three grounds: (1) people built up reserve of savings during the war; (2) expanding social security will reduce the need to save for old age; and (3) taxes will cut into savings. The Fund's estimate of savings plus taxes in 1950 adds up to a higher percentage of income than in prosperous prewar years.

The standard of living won't rise as rapidly as the total income going to consumers, because the increased income will be split up among more family units. But the average consumer unit (a family or a single person living alone) will be a third better off in 1960 than in the 1930's.

Shifts in the distribution of income will be even more important, from a marketing standpoint, than the general increase in over-all consumer income. More consumer units will be in the over-$2000 brackets than ever before and this group will be receiving a much larger share of total consumer income.

Part of the apparent increase in income is cancelled out by higher prices. To show the actual increase in purchasing power, the figures should be adjusted for an estimated one-third increase in the 1950 price level over that of the mid-1930's. This would mean that a $2,650 income in 1950 would buy no more than a $2,000 income in 1935-36. Even if this adjustment is made, the resulting figures still show a striking upward shift.

Income Class	Consumer Units in Millions		Cash Income in Billions	
	1935-56	1950	1935-36	1950
Total	39.2	47.9	$85.0	$135.0
Under $1000	20.8	13.0	17.0	7.7
$1000-2000	12.2	12.9	28.1	21.5
$2000-5000	5.5	18.2	23.8	62.1
Over $5000	0.7	3.8	16.1	43.7

FOR CONSUMERS..

In addition to dollar income, shown in the above table, consumers also receive "income in kind"—food and fuel produced by farmers for their own use, board and lodging received by domestic servants. Such income will have a value estimated at $3.3 billion in 1950, most of which will supplement the $7.7 billion received by those in the "under $1000" bracket.

The urban market will continue to be far more important than the rural market. Consumer units in cities will receive cash incomes of $3,445 on the average in 1950, more than twice the farm average of $1,635 and almost twice the small town average of $1,880.

THE FARM MARKET

These figures don't provide an accurate measure of the relative importance of the rural and urban markets because rural consumers pay a lot less for food, fuel, shelter and so have more to spend for other things. If there were any way to adjust for these things, the figures would show a smaller spread between the two markets, but the urban market will still be dominant.

All these figures underline a general upgrading in consumer demands which would accompany high-level production and employment. It will have a profound effect on marketing practices. The average person will eat better, dress better, and live in a better house with better equipment. And he will have more money to spend for travel, recreation, and luxuries.

CONSUMER MARKETS

The improvement in living standards during the 1950 decade will lead to important changes in the way consumers spend their dollars. Even though they will eat better, dress better, and live in better houses, a smaller share of the consumer dollar will be spent on food, clothing and shelter. A growing share will go for appliances, furniture, travel, and recreation.

This means that the fastest growing markets will be those providing what might be called "optional" goods and services — things which add to comfort and enjoyment but which are not strictly necessary. Markets for necessities, on the other hand, will expand at a slower rate than total consumer expenditures.

The growing importance of "optional" goods and services is one of the reasons why it's increasingly difficult to keep our economic machine going on an even keel. The purchase of "optional" goods can be postponed with little hardship. So anything that causes people to put off buying a new car, a new house, or a new radio has a far greater effect on production and employment now than it did when the major share of the consumer dollar went for necessities.

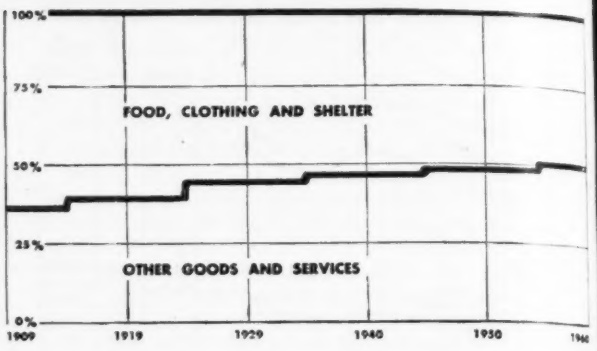
Some of the trends in major markets are summarized in the following sections.

FOOD

Although food is by far the largest item in the consumer budget, its relative importance is declining slowly as living standards rise. People eat the same number of pounds of food they ate in 1909 but the food is better from a nutritional standpoint and easier to prepare. Thus, the trend favors fruits, vegetables, and dairy products as against meat, potatoes, and bread.

More and more food is being processed in factories rather than in consumer kitchens. Improved methods of manufacture and distribution have transformed the luxury foods of yesterday into the standard foods of today. New kinds of processed foods — canned, frozen, and dehydrated — are appearing constantly.

STANDARD OF LIVING YARDSTICK: MORE OF THE CONSUMER DOLLAR GOES FOR THE COMFORTS OF MODERN LIFE



CLOTHING

Three long term trends will shape the clothing market in the future: (1) the shift from home and custom to factory fabrication is almost complete:

WHERE CONSUMER DOLLARS GO

(Figures in Billions of Dollars)

	1909	1919	1929	1940	1941	(1944 Prices) 1950	1960
Total Consumer Expenditures	28.8	60.8	80.3	70.6	80.4	116.2	134.2
Food, Liquor, and Tobacco	9.9	22.3	23.7	21.9	25.3	36.2	41.1
Food	7.4	18.8	19.9	16.4	19.0	27.2	30.8
Liquor and Tobacco	2.5	3.5	3.7	5.5	6.3	9.0	10.3
Clothing and Personal Care	4.4	9.8	12.1	9.8	11.5	16.2	18.7
Housing	6.8	10.1	14.4	12.6	13.3	19.3	21.4
Rent a.	5.5	7.9	11.3	9.1	9.7	14.0	15.4
Fuel	1.0	1.5	1.7	1.7	1.8	2.5	2.8
Electricity	0.1	0.3	0.6	0.9	1.0	1.6	1.8
Household Equipment and Operation	2.8	6.2	10.6	8.7	10.3	15.0	17.4
Appliances	0.2	0.4	0.8	1.0	1.3	1.8	2.4
Consumer Transportation	1.6	5.2	8.6	7.3	8.6	12.7	16.4
Autos and Private Planes b.	0.6	3.5	6.0	5.7	6.8	9.6	12.7
Local Bus and Street Car	—	—	0.8	0.7	0.8	1.5	1.5
Intercity Bus	—	—	0.1	0.1	0.2	0.2	0.2
Airlines	—	—	c.	c.	c.	0.1	0.5
Railroads	0.4	0.8	0.6	0.3	0.3	0.4	0.3
Medical Care, Insurance, and Death Expenses	1.1	2.8	4.5	4.7	5.2	7.7	8.7
Recreation	0.9	2.1	3.8	3.3	3.7	5.7	6.9
Radio and Television Sets	0.2	0.7	1.0	0.6	0.8	1.1	1.3
Private Education, Religion, and Welfare	1.2	2.2	2.7	2.3	2.4	3.4	3.7

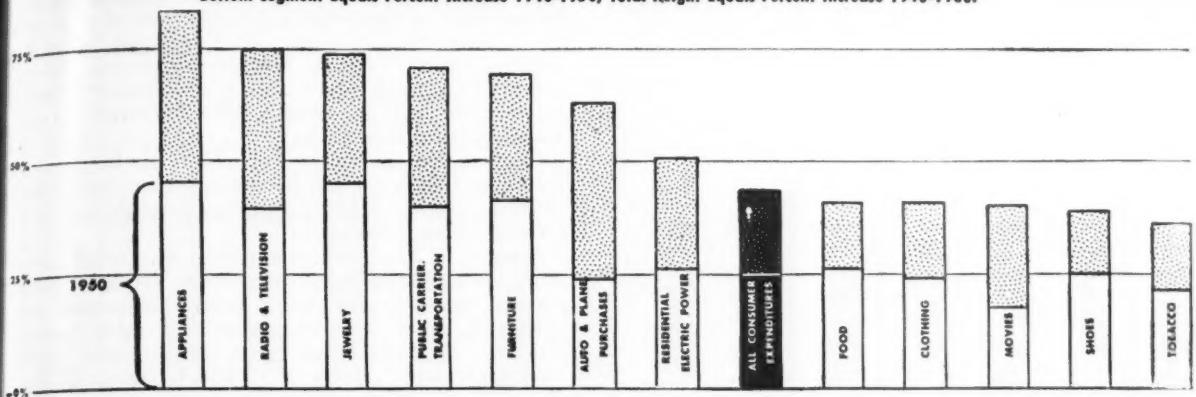
a. Includes Estimated Rent for Owner-Occupied Homes.

b. Includes Original Cost and Operating Expenses.

c. Less than $50 Million.

CONSUMER MARKETS IN 1950 AND 1960: Percent Increase in Sales Over 1940

Bottom Segment Equals Percent Increase 1940-1950; Total Height Equals Percent Increase 1940-1960.



(2) synthetics, chiefly rayon and nylon so far, are replacing cotton, wool, and silk at an accelerating pace; (3) there's greater standardization of styles and a trend to lighter and simpler clothing.

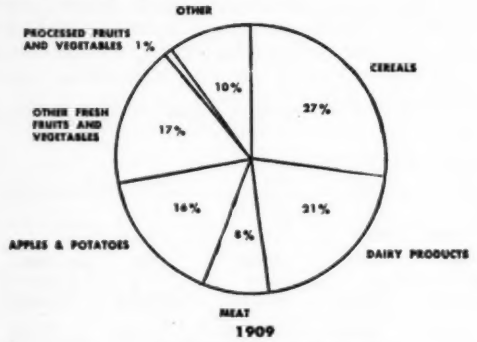
In 1909 consumers spent 14% of their income for clothing but by 1940 the ratio had reclined to 12%. However, this long run decline may be halted or reversed. The migration from farms to cities, the upgrading of incomes, and the growing demand for sports clothing will increase clothing expenditures.

HOUSING

The decline in the relative importance of housing expenditures — from 24% of consumer dollars in 1909 to less than 18% in 1940 — is expected to continue. The reason is that people feel they get more value for their dollars in other things than housing. Nevertheless, the housing market should be much larger in the 1950's than in the 1930's because much of our housing needs to be repaired or replaced.

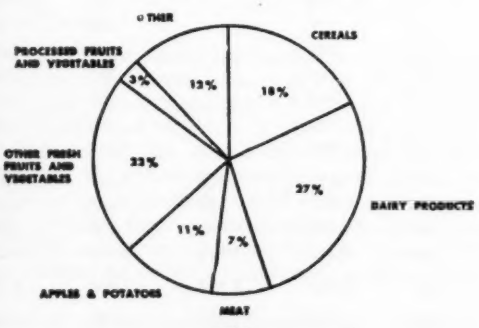
A Census survey in 1940 showed that 16 million of the nation's 37 million dwelling units needed to be replaced or needed major repairs. The 20th Century Fund estimates that the provision of adequate housing for everyone by 1960 would involve building 20 million new units and rehabilitating 5.4 million at a total cost of $115 billion (1944 prices). The Fund also estimates that we will fall 15% short of this goal even with continued high-level employment.

OUR CHANGING DIET: MORE MILK, FRUITS AND VEGETABLES LESS MEAT, POTATOES AND BREAD



1909

1880 POUNDS OF FOOD PER PERSON



1939

1882 POUNDS OF FOOD PER PERSON

HOUSEHOLD EQUIPMENT

More and more of the consumer dollar has gone for household equipment in the past four decades, largely because of the development of labor-saving appliances. The outlook is for a continuation of this trend. New appliances are being developed; and the large number of new houses slated to be built in the next few years, the wartime and postwar boom in the number of families, and the migration to the cities should add to appliance demand. The same factors should brighten the outlook for furniture, rugs, and other household items.

Some appliance markets may be saturated by the 1950's, however. A few years of high production would fill our homes with refrigerators, for example. However, replacement demand would run to 2.7 million units in 1960 and there would be a demand for 1.3 million refrigerators to equip new houses, so the market would still be bigger than in 1941 when 3.6 million were sold. However, new products must be developed if the industry is to keep up the pace it has set in the past.

TRAVEL

In 1916 the average person traveled 490 miles. By 1940 the average had grown to 2,400 miles, chiefly because of the rise of the automobile. The 20th Century Fund expects this growth to continue because as their incomes rise people spend more money traveling.

A good share of the increased spending will go to purchases of cars and planes. The Fund estimates that there will be 36 million cars on the road and 100,000 private planes in the air in 1950. The auto industry would be able to sell 5 million new cars a year after 1950 — 4 million for replacement and a million for population growth.

CAPITAL INVESTMENT

Investment plays a crucial role in our economy for two reasons. It is by plowing back part of our annual output that we are able to provide better machines and equipment to keep productivity rising. But the amount ploughed back varies widely from year to year. This unevenness of capital investment contributes to the instability of production and employment.

Because capital investment involves the purchase of durable goods, it can be postponed almost indefinitely when the outlook for profits darkens. Thus, capital investment plummeted from $18 billion in 1929 to $5 billion in 1933, a drop of 72%, whereas consumer spending fell only about half as fast in the same period.

MORE FOR EQUIPMENT

There has been an important shift in the relationship between construction and equipment, the two major types of investment. Before World War I, construction made up around three-fourths of total investment but the ratio declined to less than half in 1935-39. Part of the decline is, of course, explained by the fact that the depression left us with ample plant capacity but provided an incentive to buy more efficient machines to cut costs. Nevertheless, there is a well-defined trend towards allocating an increasing proportion of investment to equipment rather than to plant construction.

CAPITAL INVESTMENT . . .

A little less than two-thirds of total investment goes into industrial plants and equipment. Housing and other consumer construction (hospitals, schools, churches) averaged 27% of total investment during the interwar period. Housing fell from a peak of $6 billion in 1926 to $4.7 billion in 1929 and $600 million in 1933; and it had recovered only half the 1926 volume by 1940.

While other types of investment follow the ups and downs in general business, investment in housing construction follows a cycle of its own. This housing cycle is determined by factors such as the vacancy rate, the level of rents, and that of construction costs, which may not follow the trend of general business. When a drop in general business activity takes place during a declining phase of the housing cycle, as it did in 1929, the result is a deep and prolonged depression.

Government investment, of which the largest component is highways, has been much more stable than other types but it doesn't swing enough weight to stabilize total investment.

Because of the wide fluctuations in capital investment, it's much more difficult to estimate future capital expenditures than future consumer purchases. In order to make a relatively stable forecast, the 20th Century Fund bases its estimates on the long term trend since 1879, which shows a slight decline in the share of total output going to capital investment. Thus, investment under conditions of stable prosperity in the 1950 decade is estimated at 16% of total output as compared with a ratio of more than 18% in the late 1920's. On this basis, estimated capital expenditures work out to $28 billion for 1950 and $33 billion in 1960. Our ability to maintain high employment and rising living standards will depend in large measure on our ability to invest that much profitably in new machinery and buildings.

CAPITAL NEEDS

Analysis of our capital needs lends little support to the idea prevalent during the 1930's that we had reached economic maturity so that there was no way to invest as much as we had in earlier decades. No one has ever made an estimate of how much it would cost to modernize our industrial plant, which is valued at around $200 billion at prewar prices. If as much as a third of it needs to be replaced or rehabilitated, around $100 billion (current prices) of additional investment will be required.

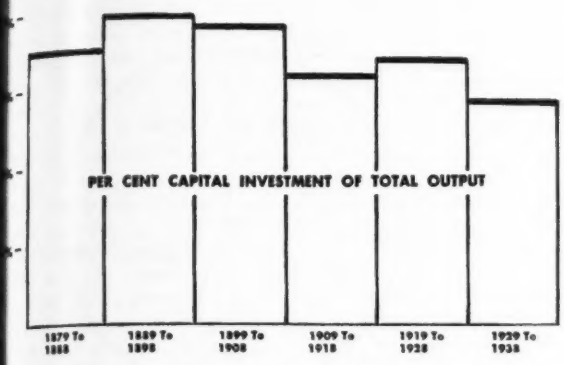
In addition, huge amounts of money need to be invested in housing and public works to raise the serv-

WHERE INVESTMENT DOLLARS GO

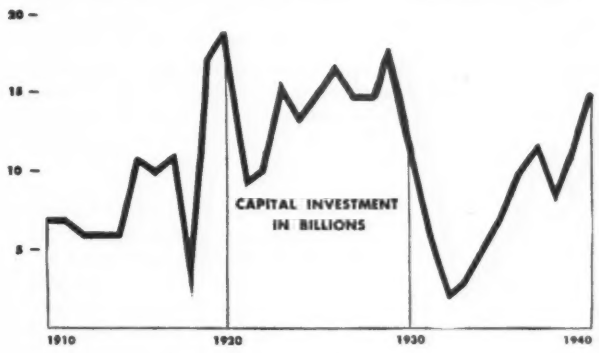
(Figures in Billions of Dollars)

	(Annual Averages)					(1944 Prices)	
	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1950	1960
Total Capital Investment	$12,428	$17,186	$8,215	$10,445	$12,340	$27,700	$33,000
All Industries	7,570	10,112	5,272	6,889	8,089	17,800	21,125
Manufacturing	1,996	2,362	1,074	1,610	3,731	4,200	5,025
Food	261	357	194	244		228	273
Textiles	227	212	92	117		175	210
Steel	138	188	110	192		853	1,021
Autos	105	150	78	146		369	441
Chemicals & Petroleum	70	95	68	142		928	1,111
Machinery	—	—	—	28		180	216
Other	510	625	213	409		1,462	1,750
Transportation	1,797	2,303	1,277	1,822	805	4,300	5,100
Commercial	1,196	1,940	777	719	833	1,950	2,300
Utility	693	999	483	422	780	1,500	1,625
Other	1,888	2,508	1,661	2,316	1,940	3,950	4,700
Consumer Construction	3,806	5,557	1,547	2,256	2,912	7,200	8,255
Government Construction	1,052	1,517	1,396	1,299	1,338	2,700	3,620

OVER THE YEARS ABOUT 1/5 OF TOTAL OUTPUT IS PLOWED BACK AS INVESTMENT



BUT THE AMOUNT PLOUGHED BACK VARIES GREATLY FROM GOOD YEARS TO BAD, ACCENTUATING THE SWINGS OF THE BUSINESS CYCLE



ces provided merely to adequate levels. The 20th Century Fund estimates that the cost of a 15 year program to modernize our city streets and rural highways would run to $40 billion. To bring the nation's housing up to minimum standards of health and decency by 1960 would cost $115 billion. To conserve our natural resources and develop our water power would cost $27 billion over a 15 year period.

There seems to be little question that needs exist for all the capital investment we can make for a long time to come. The behavior of investment in the past strongly suggests that the problem is not one of lack of needs but one of finding ways to add to our capital in an orderly fashion. Capital investment has followed the boom and bust route in the past; what is wanted is a high but steady rate of investment.

WARTIME INVESTMENT DEFICIT

Demand for capital goods is stronger right now than ever before, largely because of the backed-up needs arising out of the war. Here is how wartime expenditures for capital goods which can be used in peacetime production compared with expenditures in the last 5 years of both the 1920's and 1930's: (Figures in billions of dollars)

	1925-1929	1935-1939*	1940-1944
Total Capital investment	$86	$65	$49
Industrial	51	43	32
Manufacturing	12	10	14
Metals, chemicals, machinery, petroleum	6	6	11
All Other	6	4	3
Commercial	10	5	3
Railroads	5	3	3
Electric power	5	3	3
Consumer Construction	28	14	12
Public Works	7	8	5

* Adjusted to Wartime Prices

Wartime restrictions held investment in all civilian lines far below what would be spent in prosperous peacetime years. Thus, there was a backlog of investment needs at the end of the war which ran to more than $30 billion, if the 1925-1929 demand can be taken as typical. Whatever the precise size of the backlog, it is clearly great enough, when added to the normal yearly demand for new investment, to keep the heavy goods boom going for some time to come. The test of our ability to stabilize capital investment will come later.

There is also a huge foreign demand for American capital. How far we will go toward meeting this depends largely on whether international political and economic conditions are stable enough to make private foreign investment a good risk.

If we invest abroad in the same proportion we did in the late-1920's, our foreign investments will total $1.6 billion during the year 1950 and $1.5 billion in the year 1960. This will mean a net increase in our foreign holdings of $15 billion during the 1950's, raising the total of such holdings to about $25 billion, as against a total of $10.6 billion in 1940.

To make that much foreign investment pay out, an expanding volume of world trade would be required. Foreign nations would have to get enough dollars not only to pay for goods they bought from us but also to pay interest and dividends on U. S. investments. If our overseas investments increase to $25 billion by 1960, annual interest and dividends owed us will run to almost $1¾ billion.

To pay us that much, foreign nations would have to sell much more in the U. S. than ever before. The 20th Century Fund calculates that imports of $7.3 billion in 1950 and $8.1 billion in 1960 would provide other countries with the dollars they need. Imports ran to $2.5 billion in 1940 so we would have to buy 3 times as much abroad to keep expanding our foreign investments.

With good business, U. S. demand for imported goods should be well above prewar. Rising living standards will widen the market for such consumer items as British tweeds and French perfumes. Moreover, we will need to import more raw materials than ever before because we used up our natural resources at a prodigious pace during the war.

NEW INDUSTRIES

The new methods, materials, and products developed during the war may well have a more profound and lasting effect on future capital requirements than the backed-up demands accumulated in wartime. Here are some of the wartime developments which may have important peacetime applications: new chemical processes and products including synthetic rubber, plastics, synthetic fibers and fabrics; new food products and new methods of food processing; new uses for glass, plywood, and the light metals; tremendous advances in aviation; and new applications of atomic energy and fissionable products in power production and medicine.

Large capital expenditures will be required to push these developments further and adapt them to civilian use. New businesses and perhaps entire new industries will grow up, adding to the demand for capital goods for many years.

THE COST OF GOVERNMENT

To the traditional certainty of death and taxes can be added the certainty that the cost of government will take a much larger share of national income than ever before in peacetime. After the Civil War and again after World War I, federal expenditures moved up to a level four times prewar. And it is already clear that World War II is going to have about the same effect.

In 1940, federal, state, and local governments spent $19 billion, of which a total of $2.2 billion went for national defense, veterans, and interest on the war debt. By 1950, the 20th Century Fund estimates that all governmental units in the U. S. will be spending more than $45 billion. Federal expenditures are estimated at $27.6 billion in that year as against $9 billion in 1940.

Part of the increase is explained by higher postwar prices. Adjusting for price changes would reduce the 1950 figure from $45 billion to $33.5 billion. This is still 80% above the 1940 level. Increased expenditures for public works, social insurance, and schools explain another small part of the rise.

But costs arising out of the war are by far the most important factor. Military and veterans' expenditures and interest on the war-swollen national debt will add up to over $17 billion in 1950. This is only 10% less than total government expenditures in 1940.

The only major category of government expense which would be lower in 1950 is welfare. With high-level employment and more social insurance, relief and other welfare costs should run to $2.5 billion in 1950 as against $3 billion in 1941.

The following paragraphs describe important trends in the major items of government expense.

MILITARY

The 20th Century Fund assumes that we will maintain an armed strength of 2 million men (including trainees) and that it will cost $3,300 to equip and maintain each man, so total military expenditures will run to $6.6 billion. But even if we decide to maintain a smaller armed strength, the total cost might easily be at least $6.6 billion because the present per serviceman cost of over $6,000 a year may not decline.

AND GOVERNMENT ...

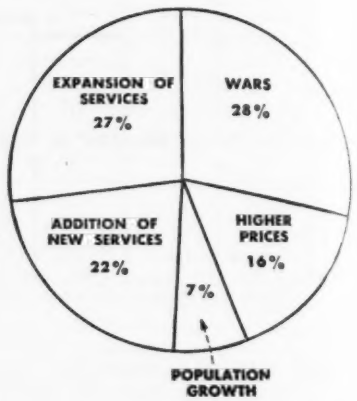
VETERANS

It will cost at least $2.9 billion to take care of veterans in 1950 even if benefits are not increased. That's 5 times the 1941 cost. Pensions for World War I veterans rose steadily from $116 million in 1924 to over $300 million in 1945. That rise will continue for another 20 years. By far the largest expense will be for World War II pensions which are already costing $900 million. Disability and death benefits will cost about $1¾ billion in 1950; hospitalization will add another $250 million; and insurance $150 million.

SOCIAL SECURITY

Future expenditures for social security will depend on whether steps are taken to extend coverage and liberalize benefits. Over 60 million people are now covered so the cost is certain to increase rapidly as more of them begin to draw payments. With high-level employment in 1950, estimated old age and unemployment benefits under the present system would run to over $5 billion. Expansion of benefits, as recommended by the Social Security Board, would raise the cost to over $9 billion.

WHY THE COST OF GOVERNMENT HAS INCREASED. The $25.6 billion increase in cost from 1913 to 1941 was due to:



PUBLIC WORKS

Even an economy-minded Congress is almost certain to go along with expenditures for highways, airports, waterways, flood control and conservation. Thus, an increase in expenditures for transportation and natural resources from less than $2.5 billion to over $5 billion in 1950 seems probable.

SCHOOLS

Education ranks third among all government expenditures. In 1941 we spent almost $2.5 billion—10% of all government dollars—on schools. Teachers' salaries account for almost three-quarters of the total cost so the trend towards higher salaries will boost the nation's bill for education.

WHERE TAX DOLLARS GO

(Figures in Billions of Dollars)

	1913	1932	1941	1950 (1944 Prices)	1960 (1944 Prices)
All Government Expenditures	2.5	12.4	23.1	45.5	50.7
Federal	0.7	4.3	12.9	27.6	28.6
State	0.2	1.8	3.6	7.0	9.3
Local	1.6	6.3	6.6	10.9	12.8
Military	0.27	0.7	6.1	6.6	6.6
Veterans	0.18	0.8	0.6	2.9	3.2
Interest	0.15	1.3	1.7	7.9	8.1
Social Insurance	—	0.2	1.9	7.7	8.7
Welfare & Health	0.31	1.5	4.1	4.0	4.1
Education	0.65	2.5	2.7	3.7	4.3
Public Works	a.	a.	a.	5.6	7.1
Transportation	0.40	1.9	2.0	1.8	2.7
Natural Resources	0.03	0.6	1.4	1.2	1.1
Police & Fire	0.19	0.7	0.7	1.0	1.1
Other	0.40	2.4	2.0	3.0	3.6

a. Included in other groups.

NATURAL RESOURCES

The war left the U. S. with a depleted supply of most natural resources, and with critical shortages of some of the most essential minerals. Nevertheless, lack of natural resources should not be a limiting factor on our productive capacity. With relatively free access to world markets, we should be able to get all the raw materials we need. And, even if we were denied access to world markets, we could use our low-grade reserves and develop substitutes without causing a prohibitive reduction in our living standards, though everyone would feel the effects in one way or another.

The U. S. economy consumes about a billion and a half tons of raw materials each year, or about 11.5 tons per person. Of this 3.5 tons are coal, 1.5 tons are petroleum, and iron and copper ore each contribute about a half a ton. In 1939 the value of unrefined minerals output was $4.2 billion and 2% of all workers were engaged in mining or lumbering.

FUTURE REQUIREMENTS

The level of industrial production projected by the 20th Century Fund would raise minerals requirements a third above 1940 by the year 1950 and 50% above 1940 a decade later. Here is how natural resources requirements in the 1950 decade would compare with 1940 and the wartime peak: (Index numbers, 1940 equals 100)

	Wartime Peak	*1950*	*1960*
All minerals	138	133	151
Metals	157	117	126
Fuels	130	141	164
Other	141	128	142
Lumber	126	93	76
Electric Power	159	173	224
Manufactured Gas	120	94	75

The capacity of our supplies of natural resources to support future levels of output cannot be determined with any great accuracy. It will depend on the size of our reserves and on our ability to use supplies more economically and develop substitutes.

TH THE OURCES AILABLE . . .

Because there is no way to measure these factors with any degree of precision, all estimates of the number of year's supply are subject to wide errors. However, such estimates are useful in directing attention at those resources where every effort should be exerted to develop new supplies, substitutes, and more economical methods of use.

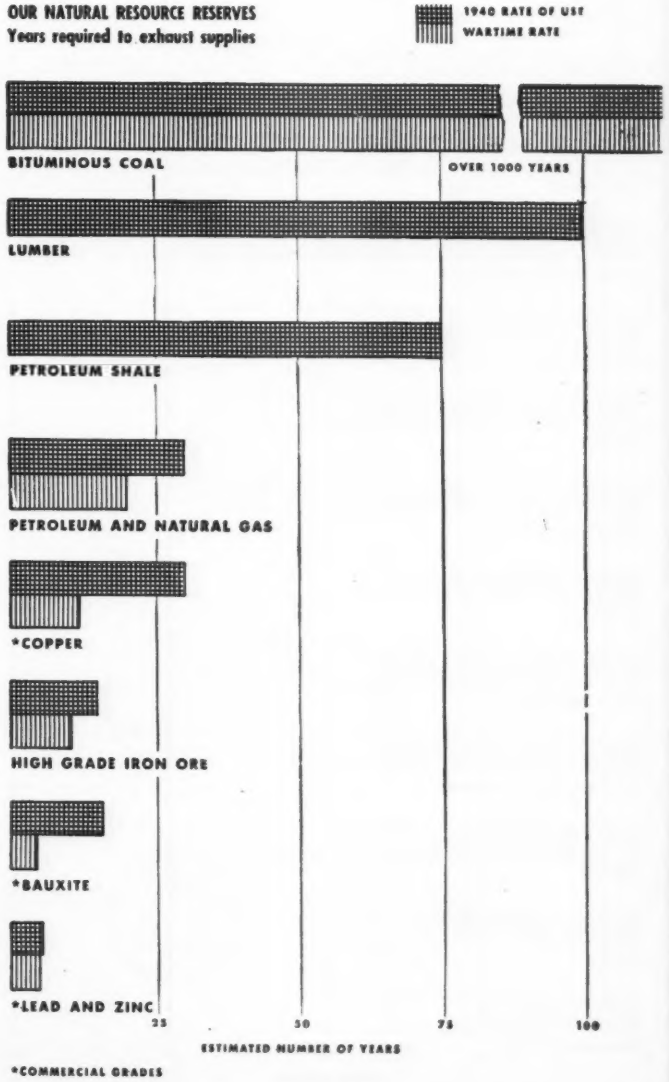
BIGGEST PROBLEMS: LEAD AND ZINC

Commercial grades of zinc, lead, and bauxite will be exhausted before 1960 even if the rate of use is cut to half the wartime rate. Supplies of petroleum and natural gas—which furnish 40% of our energy—will last longer than 20 years but their partial depletion will raise many technical and economic problems long before that time. Possible exhaustion of high-grade deposits of such minerals as iron and copper in the foreseeable future will stimulate development of processes to use low-grade deposits.

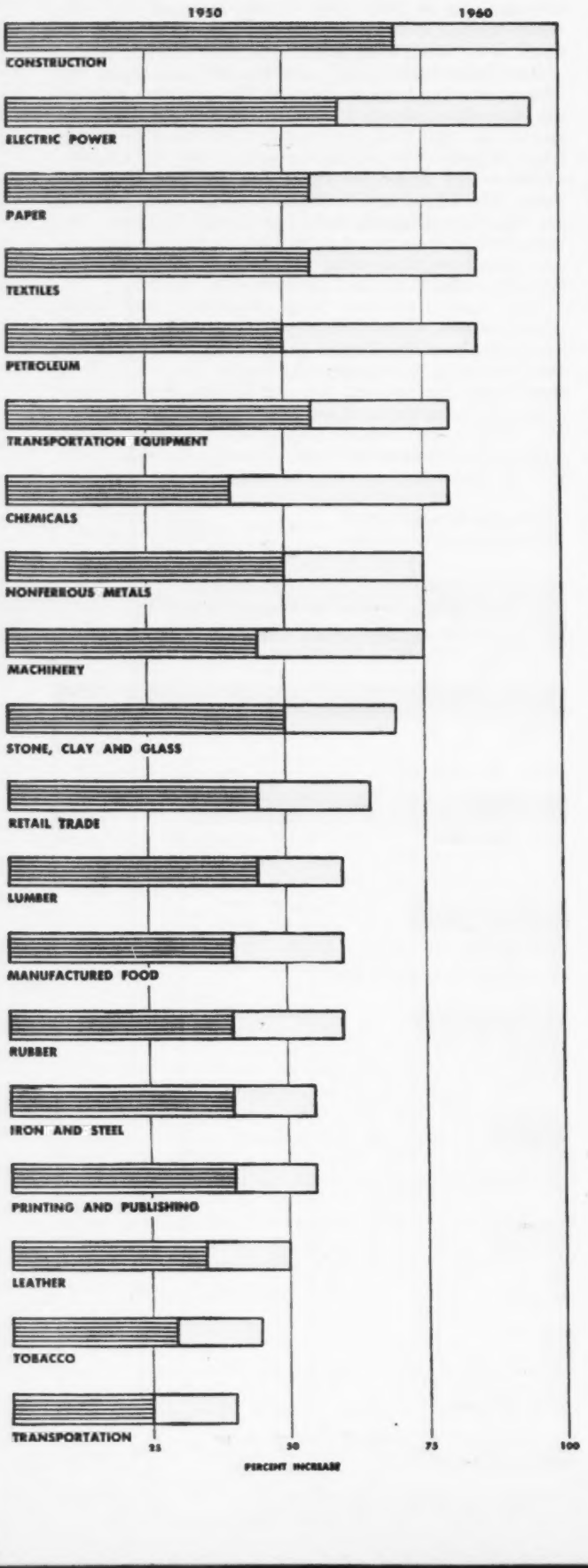
We have been discovering more and more ways to stretch our supplies of natural resources, however. In the case of tin, the electroplating process saves 50% of the tin used in tinplate production. The electric power industry uses less than 40% as much coal per kwh now as in 1920. The development of new materials and new ways of using old materials also expands our resource capacity.

Our bituminous coal reserves are adequate for over a thousand years even at the wartime rate of use, though production costs might rise substantially as inferior coal beds were used. After that, there are huge deposits of sub-bituminous coal and lignite which could carry us along for another thousand years. In comparison, maximum petroleum reserves are minute, adequate only for about 30 years consumption at the current rate. That is why the experts are trying to find ways to produce oil from coal cheaply enough to be commercially feasible.

Even though we have been using up lumber faster than it grows, there is little doubt that enough will be available in the future to meet at least minimum needs. Annual timber growth runs to about 32 billion board feet. But we cut over 40 billion board feet a year before the war and lost another 6 billion through fire, insects, and disease. An adequate conservation program could increase annual growth enough to offset this depletion.



PRODUCTION PROSPECTS: Estimated Percentage Increase in Industrial Activity Over 1940



INDUSTRIAL CAPACITY

At the end of World War II U. S. industry found itself with surplus capacity in some lines and serious deficiencies in others. There was more than enough aircraft, machine tool, and synthetic rubber capacity but not nearly enough sheet steel, copper, or electrical machinery capacity to meet pent-up demands.

War experience showed, however, that industrial capacity can be expanded enormously in a few years, given the need and the funds. Thus lack of industrial capacity should not prove a bottleneck to meeting the demands of consumers in the 1950 decade.

A rough estimate places our total investment in industrial facilities (manufacturing, mining, transportation, and distribution) at $200 billion. Just how much capacity industry as a whole, or any given industry, has is impossible to measure.

Capacity is a most elusive concept. In a technical sense, the capacity of an industry is the combined production of all its plants working 24 hours a day, 365 days a year, less an allowance for repairs, breakdowns, and other technical factors. Actual capacity is far less, however. Some facilities are obsolete or high-cost. Supplies of raw materials and components may be insufficient to keep assembly plants running full-steam. Moreover, demand for many products isn't great enough to support round-the-clock production.

PLENTY OF CAPACITY

During the past quarter century, however, experience shows that we have had more than enough overall capacity, and more than enough capacity in almost every industry, to meet all demands. An extensive study showed that even in 1929 only the steel and machine tool industries were definitely operating at capacity.

The growth of productivity as old machines are replaced with new and more efficient ones and as new techniques are developed is one of the main reasons why industrial capacity more than keeps pace with markets. The depression of the 1930's led to a net retirement of about 5% of total manufacturing facilities but manufacturing plants in 1939 could have turned out a quarter more than in 1929 because productivity was a third higher.

Whenever an industry's output begins to approach technical capacity, it becomes profitable to purchase new and more efficient equipment to replace or supplement existing machines so that a certain amount of excess capacity seems to be inevitable in a free enterprise system.

Estimates of the level of industrial production in different lines under conditions of high-level employment during the 1950 decade are shown in the chart. They assume that past trends will continue so that they give only a rough idea of what would happen to output in each industry. Unpredictable shifts of consumer demand or new product developments might cause a big change in the pattern of industrial production. Such estimates are, nevertheless, useful in that they provide a clue to lines where the largest increases may take place.

None of the projected increases are so large as to tax our ability to provide enough capacity. This is not to say that there will be no bottlenecks because of lack of capacity for certain components, for instance. However, we should be able to make good in short order any deficiencies of that sort that may develop.

EMANDS VERSUS NEEDS

Despite the substantial increase in living standards hich would be possible with high-level production nd employment in the 1950 decade, many U. S. onsumers will be unable to buy enough of life's ecessities to maintain themselves at a health and ecency level. Almost 30% of all families would re-eive less than $1,000 a year cash income and one-hird of this group would receive less than $500.

The 20th Century Fund asked a series of experts o estimate the quantities of food, clothing, housing, edical care, and other things needed to provide a tandard of living at a minimum health and decency evel. The experts also figured out how much it would ost to bring everyone expected to be below that stand-rd in 1950 and 1960 up to the calculated level. In ther words, the estimates show the cost of establish-ng a "floor" for consumption without disturbing the pending patterns of those who received more than nough income to satisfy the calculated minimum eeds.

STIMATES OF NEEDS

Any estimate of "needs" must rest upon someone's pinion as to what constitutes "health and decency" n this day and age. In the case of food, the nutri-ional requirements of a minimum health and de-ency standard can be determined accurately. In ther fields, such as housing and education, even the xperts would disagree over what constitutes a mini-num standard.

However, what is important is not the precise size f the estimates but their general magnitudes. The onclusion that we would have to spend about 50% nore on medical care than we are likely to in 1950 s important even if the experts' appraisals of the defi-it range from as high as 60% to as low as 40%.

To fill total needs calculated in this manner would equire production of $200 billion of goods and ervices in 1950 or 13% more than the $177 billion hich would be turned out with high-level produc-tion and employment. In 1960, estimated production would fall short of needs by 8%. Food accounts for the biggest share of the deficit but needs outrun demand by important margins in housing, medical care, education, and social security.

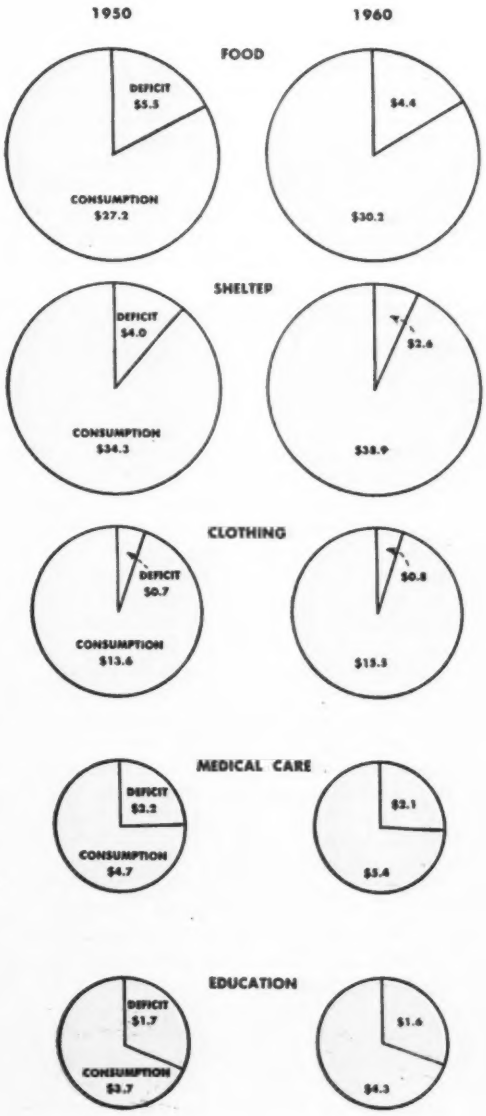
MEET
OST ALL
NEEDS

To provide nutritionally adequate moderate-cost meals for those unable to afford them would add $5.5 billion to the $27.2 billion that would actually be spent on ood in 1950. This assumes no change in diets of those ith adequate incomes despite the fact that many eople in those groups do not eat what they should. f we all ate what we needed, we would consume twice s many fresh vegetables as in 1940, half again as much milk, more fruits and tomatoes; and we would eat maller quantities of sugar, sirups, fats, and oils. This better diet would cost us less than we will actually pend for food in 1950.

So large a portion of our existing housing is un-satisfactory by any reasonable standards that it would take 10-15 years to provide everyone with adequate housing. One of the reasons why we don't have ade-quate housing is that many consumers cannot afford to pay enough rent to finance it. Estimated expendi-tures in 1950 for rent (including the estimated rental value of owner-occupied homes) would run to $14 billion as against an estimated need of $16.4 billion.

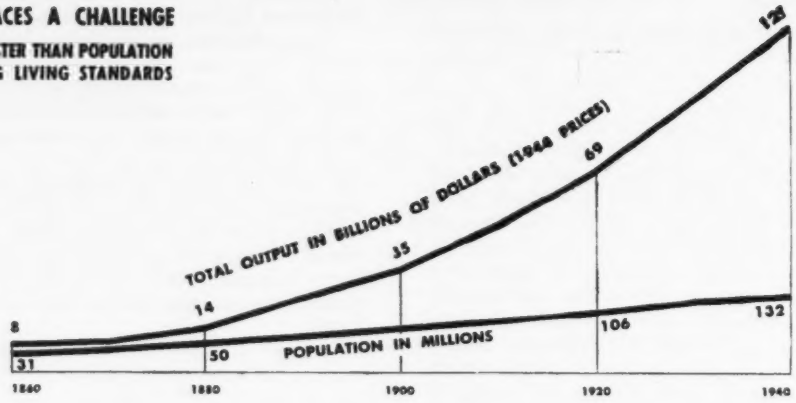
Vast advances in medicine have gone far toward eliminating many diseases and have brought about a steady improvement in the standard of health. How-ever, large numbers of people in the lower income groups cannot afford adequate medical care. More-over, to supply good medical care for everyone under the traditional fee-for-service basis would cost several times more than consumers have ever spent for medical services even in prosperous years. Development of an effective form of group medicine, however, would make it possible to provide adequate care at a great saving over present costs, according to the 20th Century Fund.

HOW CONSUMPTION WOULD COMPARE WITH TOTAL NEEDS
(Figures in billions of dollars)



THE U. S. ECONOMY FACES A CHALLENGE

PRODUCTION HAS GROWN FASTER THAN POPULATION GIVING PROMISE OF RISING LIVING STANDARDS



The major conclusion of the 20th Century Fund's survey of America's needs and resources is that we have reached a point where we can provide everyone with a decent living and most people with a living which, by any standards other than our own, is positively luxurious. With high-level employment, it would take only a 13% increase in total output in 1950, and an 8% increase in 1960, to lift everyone to a minimum health and decency standard of living.

We have more than enough industrial and agricultural capacity to support that much of an increase in total production. Lack of natural resources should not be a bottleneck, for with world trade on any sort of a reasonable basis we will be able to get all the raw materials we need.

The only limiting factor is the capacity of our labor force to produce. The 20th Century Fund assumes that productivity will advance at the average rate actually achieved during the past 9 decades (18%). But there is no technical reason why we cannot achieve an increase of more than 30%. That would make possible enough production to meet our minimum needs.

The U. S. economy has exhibited two dominant characteristics in the past century. Our productive capacity has expanded at a rate never approached elsewhere. But our economy has also been highly unstable. Our problem is to make the most of our unparalleled technological and productive know-how while minimizing the swings of the business cycle.

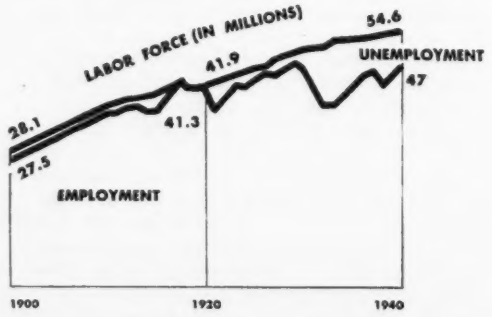
If we can meet that challenge, we can eliminate the specter of want and move on toward constantly rising living standards for everyone. Never before in history has a nation been so close to abolishing poverty and meeting the material demands of its citizens

This is not to say that solving the problem of maintaining stable and expanding production would solve all our economic, social, and political problems. Nor is it to say that a solution of the problem of keeping our economic machine running on an even keel is at hand.

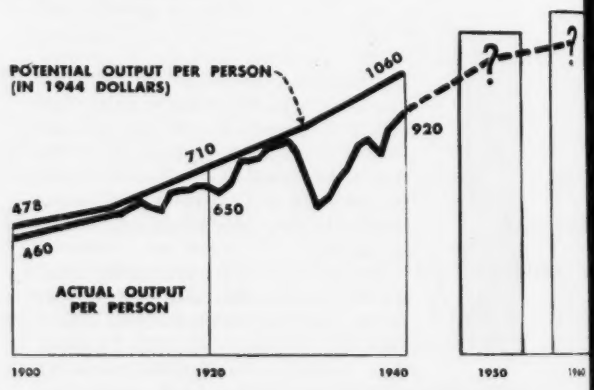
In the first place, the U. S. would not be a utopia even if we achieved the kind of high employment and production the 20th Century Fund is talking about. Many perplexing problems of how to best distribute our production would remain. Then there are a host of social and political problems which would still tax our efforts and ingenuity. Finally, there is the all-important question of how to maintain world peace.

Most people would agree that the problem of maintaining high employment and rising living standards is still far from solution. Our ability to mobilize and direct our economic resources so as to keep our economy running on an even keel has lagged behind our ability to solve technical production problems. Each businessman, each worker, and each consumer must somehow learn to act differently in many ways than he has in the past if we are to solve our number one economic problem.

BUT THE GROWTH HAS FOLLOWED THE BOOM AND BUST ROUTE INVOLVING LONG PERIODS OF MASS UNEMPLOYMENT



CAN THE ECONOMY PROVIDE STEADY EMPLOYMENT AND RISING LIVING STANDARDS?



Just what changes in our economic life will be necessary no one knows. On our ability to find out these things and put them into practice in the next few years depends our success in meeting the challenge which the 20th Century Fund's study underlines. That challenge is that we have within our grasp the ability to eliminate actual want from the U. S. and to provide more and more things for better living for everyone.

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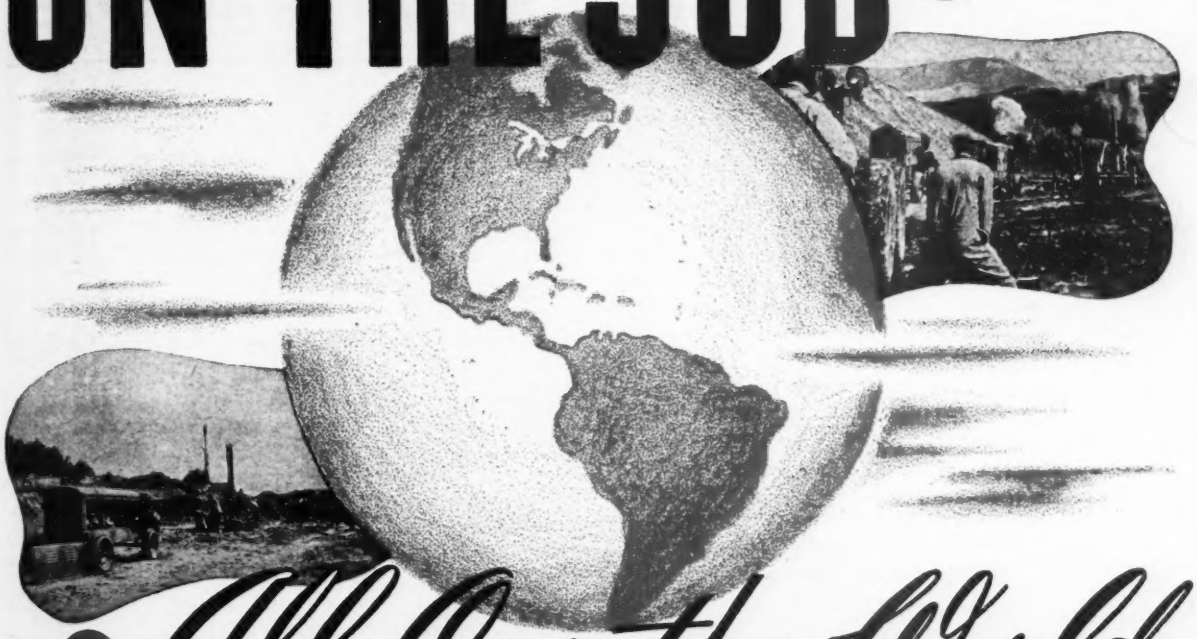
ON THE JOB



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SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
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Air WHERE, WHEN AND AS MUCH AS YOU NEED.

UNIT PRICES BID BY CONTRACTORS

Big Thompson Project, Colorado

OWNER: Bureau of Reclamation, Denver, Colorado.

PROJECT: Construction of earthwork and structures for Aspen Creek siphon; Marys Lake power plant, penstock, spillway, and switchyard; Marys Lake Reservoir dikes and road relocation; Prospect Mountain conduit; and Estes power plant, penstock, and switchyard. This work is all included in the Big Thompson Project, Colorado.

CONDITIONS: Work is divided into five schedules, and each schedule may be awarded separately, at the option of the government. Contract time for Schedules 1 and 2 is 800 calendar days, and for Schedules 3, 4, and 5, 730 calendar days. Government furnished materials include sand and coarse aggregate for use in concrete; concrete, cast iron or clay sewer pipe; corrugated metal pipe culverts and corrugated connecting bands for joints; mineral surfaced roofing, structural steel framework for supporting roofs over the generator rooms of the power plants; bulkhead gates; track rails for crane runways and for transformer tracks; steel and cast iron pipe for permanent water supply, air piping, and vent piping; other materials that will become a part of the completed job.

Schedule 1—Estes Power Plant and Switchyard

DESCRIPTION: The Estes Power Plant will be located on the right bank of the Big Thompson River. It is to be 98 ft. x 145 ft., of reinforced concrete construction with structural steel and roof framing. It will house three main generator units, each consisting of a 16,667-kva, vertical shaft generator with direct-connected exciters, driven by a 21,000-horsepower turbine. It will contain a main-control room, a transformer and switchgear room, an electrical laboratory, a ventilating equipment room, a machine shop, an electrical shop, and a battery room. It will also be equipped with an 80-ton traveling crane, which will be furnished by the government. The switchyard will connect directly to the power plant by large metal accordion doors, and will be approximately 100 ft x 350 ft. The roof will be covered with 5-ply built-up coal-tar saturated felt roofing complete with gravel surfacing. The transformers and oil circuit breakers will be located in the switchyard, which will be surfaced with gravel. It will also contain switchgear and bus structures for which footings and foundations only are to be constructed. The terrazzo floor finish in the lobby and generator room, the linoleum in the control room, and the suspended ceiling over the mezzanine section of the power plant will be installed by the government.

BIDS: Two bids were received January 15, 1947 on Schedule 1. Contract was awarded to the low bidder.

1. Morrison-Knudsen Co. Inc. Boise, Idaho and Peter Kiewit Sons Co., Omaha, Nebraska — $921,216.75
2. Winston Bros. Co. and Al Johnson Const. Co., Minneapolis, Minn. — 1,024,278.00

	Item	Quantity	Unit Prices (1)	(2)
1	Excavation, common	26,975 cy	$0.65	0.96
2	Excavation, rock	9,435 cy	4.20	2.00
3	Fill	27,590 cy	0.25	1.00
4	Compacting fill	27,590 cy	0.50	1.20
5	Furnishing and placing topsoil fill	6,000 cy	2.00	3.10
6	Overhaul	3,000 st cy	0.06	0.03
7	Dry-rock paving	3,500 sy	5.40	3.60
8	Dumped riprap	1,200 cy	3.00	5.85
9	Furnishing, placing gravel surfacing on switchyard	900 cy	6.00	5.20
10	Furnishing and placing gravel or cr. rock for base crse. of road and parking-area surfacing	1,800 cy	6.00	3.90
11	Watering base course	108,000 gal	0.004	0.003
12	Furnishing, applying asphaltic mat. for prime coat	7,300 gal	0.30	0.18
13	Furnishing and placing gravel or crushed rock for surf. crse.	800 cy	6.00	4.50
14	Furnishing and applying asphaltic material for surf. crse.	15,000 gal	0.30	0.20
15	Mixing, finishing, and rolling surface course	10,100 sy	0.30	0.19
16	Furnishing, applying asphaltic material for sealcoat	2,800 gal	0.30	0.19
17	Furnishing and applying coarse sand for seal coat	27 cy	14.00	7.00
18	Constructing 6" dia. sewerpipe drains with uncemented joints	350 lf	2.00	2.10
19	Constructing 8" dia. sewerpipe drains with cemented joints	980 lf	3.00	3.10
20	Const. 12" dia. sewerpipe drains with cemented joints	475 lf	4.00	4.40
21	Const 12" dia. corrugated-metal pipe culverts	120 lf	2.00	2.40
22	Drilling holes for anchor, grouting bars in place	510 lf	2.00	1.90
23	Concrete in power-plant substructure	3,800 cy	34.00	36.00
24	Concrete in power-plant superstructure	1,575 cy	70.00	90.00
25	Second-stage concrete in power plant	2,500 cy	29.00	18.00
26	Concrete in blockouts	20 cy	90.00	125.00
27	Placing bonded concrete floor finish	2,300 sy	4.70	4.75
28	Concrete in switchyard foundations	775 cy	38.00	60.00
29	Concrete in switchyard tunnel	278 cy	35.00	52.00
30	Concrete in switchyard ducts	300 cy	32.00	40.00
31	Concrete in retaining walls	650 cy	31.00	90.00
32	Concrete in sidewalks	5,455 sf	0.42	0.40
33	Concrete in combined curbs and gutters	1,180 lf	1.60	2.90
34	Furnishing and handling cement	15,200 bbl	4.40	4.68
35	Furnishing and placing reinf. bars ¾" dia. and larger	1,010,000 lb	0.12	0.12
36	Placing metal sealing strips	1,400 lf	1.10	1.50
37	Placing joint filler	350 sf	2.60	0.26
38	Constructing control joints	440 lf	2.60	3.00
39	Insulating reinf. bars and electrical metal conduits (price per intersection)	160 ea	3.90	0.55
40	Placing coal-tar-saturated felt roofing, compl. with flashing	12,000 sf	0.20	0.16
41	Placing 5-ply membrane waterproofing	1,200 sf	0.20	0.16
42	Placing 2-ply membrane waterproofing	560 sf	0.20	0.15
43	Damp proofing outside walls	1,550 sy	0.90	0.94
44	Installing glass-block panels	1,680 sf	1.50	2.20
45	Installing bulkhead gates	6,000 lb	0.09	.06
46	Installing gate guides, latches for bulkhead gates	4,500 lb	0.21	0.09
47	Installing butterfly valves	216,000 lb.	0.14	0.06
48	Erecting structural metal framework	210,000 lb	0.13	0.07
49	Installing rails, ties, and ballast	190 track f	8.00	10.00
50	Installing rails in concrete	29,200 lb	0.06	0.07
51	Installing cranes	132,500 lb	0.06	0.06
52	Installing standard metal pipe, fittings, and valves less than 6" in size	45,100 lb	0.40	0.33
53	Installing standard metal pipe, fittings, and valves 6" or more in size	70,000 lb	0.22	0.22
54	Installing steel pipe railings	4,000 lb	0.35	0.22
55	Installing embedded metal frames for openings in floors and walls	9,900 lb	0.13	0.22
56	Installing metal gratings, floor plates, cover plates	26,900 lb	0.07	0.09
57	Installing oil storage tanks	8,600 lb	0.07	0.06
58	Installing pumps	4,200 lb	0.24	0.15
59	Installing metal accordion doors	504 sf	1.30	2.50
60	Installing metal swinging doors	750 sf.	1.30	2.40
61	Installing metal fire doors	64 sf	1.30	2.50
62	Installing metal-sash windows	160 sf	1.30	2.40
63	Installing metal louvers	1,500 lb	0.60	0.33
64	Installing metal inserts	3,500 lb	0.37	0.33
65	Installing miscellaneous metalwork	21,400 lb	0.34	0.33
66	Installing plumbing fixtures, appurtenant hardware	1,500 lb	0.26	1.20
67	Installing embedded electrical metal conduit 1¼" or less in dia	7,000 lf	0.30	1.20
68	Installing embedded electrical metal conduit more than 1¼" and not larger than 3" in dia	8,200 lf	1.30	1.50
69	Installing electrical embedded metal conduit larger than 3" in dia	500 lf	2.30	1.90
70	Installing embedded electrical nonmetallic conduit	25,000 lf	0.53	1.80
71	Installing ground wires and ground rods	1,600 lb	2.00	0.37
72	Transporting freight of all kinds for the Government or its agents, other than the contractor, bet. the railroad station and the power-plant site.	1,660 ton	10.50	9.00

Schedule 2—Marys Lake Power Plant and Switchyard

DESCRIPTION: The Marys Lake Power Plant will be located on the southwest side of Marys Lake. It will be of reinforced concrete construction with structural steel roof framing, approximately 62 ft. x 64 ft. It will house one main generating unit, station-service equipment, and an outlet-works, and will contain a main-control room, a transformer room, a switchgear room, an oil storage room, an air compressor room, and a battery room. The power plant will be equipped with a 50-ton traveling crane supplied by the government. The main generator unit will consist of a 9000-kva, vertical shaft generator with a direct-connected exciter, driven by an 11,300-horse-

Continued on next page

Big Thompson Project, Colorado

Continued from preceding page

power turbine. The switchyard, 40 ft. x 90 ft., will connect directly to the power plant through metal accordion doors. The roof will be covered with 5-ply built-up coal-tar saturated felt roofing complete with gravel surfacing. Hydraulic and electrical apparatus will be installed by the government, but the contractor must place all concrete around the apparatus. Transformers and oil circuit breakers will be located in the switchyard, which will be surfaced with gravel. In addition, the switchyard will contain switchgear and bus structures for which footings and foundations only are to be constructed.

BIDS: Two bids were received January 15, 1947 on Schedule 2. Contract was awarded to the low bidder.

1. Morrison-Knudsen Co. Inc., Boise, Idaho, and Peter Kiewit Sons Co., Omaha, Nebraska — $289,494.65
2. Winston Bros. Co. and Al Johnson Const. Co., Minneapolis, Minn. — 322,556.00

	Item	Quantity	Unit Prices (1)	(2)
73	Unwatering foundation for power plant	lump sum	$15,000.00	$28,300.00
74	Excavation, common	2,075 cy	0.65	0.92
75	Excavation, rock	4,160 cy	4.20	2.10
76	Excavation, rock, for keys for switchyard foundations	40 cy	30.00	40.00
77	Fill	1,130 cy	0.50	1.10
78	Compacting fill	1,130 cy	1.00	1.10
79	Dumped riprap	160 cy	3.00	5.75
80	Furnishing, placing gravel surfacing on switchyard	70 cy	6.00	5.00
81	Constructing 6" dia. sewerpipe drains with uncemented joints	80 lf	2.00	2.00
82	Drilling holes for anchor, grouting bars in place	420 lf	2.00	1.90
83	Concrete in power plant substructure	1,400 cy	44.00	37.00
84	Concrete in power plant superstructure	500 cy	75.00	106.00
85	Second-stage concrete in power plant	500 cy	33.00	17.50
86	Concrete in blockouts	5 cy	99.00	130.00
87	Placing lightweight concrete fill on floor	35 cy	20.00	30.00
88	Placing bonded concrete floor finish	900 sy	4.70	4.85
89	Concrete in switchyard foundations	70 cy	48.00	60.00
90	Concrete in switchyard ducts	15 cy	38.00	40.00
91	Concrete in retaining walls	500 cy	28.00	90.00
92	Furnishing and handling cement	4,600 bbl	4.40	4.68
93	Furnishing, placing reinf. bars ¾" dia., larger	357,000 lb	0.12	0.12
94	Placing metal sealing strips	100 lf	1.10	1.50
95	Constructing control joints	120 lf	2.60	3.00
96	Insulating reinf. bars and electrical metal conduits (price per intersection)	60 ea	3.90	0.55
97	Placing coal-tar-saturated felt roofing, compl. with flashing	3,000 sf	0.20	0.16
98	Placing 2-ply membrane waterproofing	400 sf	0.20	0.16
99	Dampproofing outside walls	500 sy	0.90	0.95
100	Installing glass-block panels	300 sf	1.50	2.20
101	Installing bulkhead gates	11,000 lb	0.09	0.06
102	Installing gate guides, latches for bulkhead gates	2,200 lb	0.21	0.08
103	Erecting structural metal framework	24,000 lb	0.13	0.06
104	Installing rails, ties, and ballast	75 track f	8.00	10.00
105	Installing rails in concrete	17,150 lb	0.06	0.06
106	Installing crane and hoist	89,200 lb	0.06	0.06
107	Installing standard metal pipe, fittings, and valves less than 6" in size	14,600 lb	0.40	0.33
108	Installing standard metal pipe, fittings, and valves 6" or more in size	24,000 lb	0.22	0. 2
109	Installing steel pipe railings	3,400 lb	0.35	0.22
110	Installing embedded metal frames for openings in floors and walls	3,150 lb	0.13	0.22
111	Installing metal gratings, floor plates, coverplates	10,800 lb	0.07	0.09
112	Installing oil storage tanks	7,500 lb	0.07	0.06
113	Installing pumps	2,100 lb	0.24	0.15
114	Installing metal accordion doors	300 sf	1.30	2.40
115	Installing metal swinging doors	212 sf	1.30	2.50
116	Installing metal fire doors	40 sf	1.30	2.40
117	Installing metal louvers	600 lb	1.30	0.33
118	Installing metal inserts	1,600 lb	0.37	0.33
119	Installing miscellaneous metalwork	4,500 lb	0.34	0.33
120	Installing plumbing fix., appurtenant hardware	380 lb	0.26	1.20
121	Installing embedded electrical metal conduit 1¼" or less in diameter	1,500 lf	0.80	1.20
122	Installing embedded electrical metal conduit, more than 1¼" and not larger than 3" in dia.	2,700 lf	2.30	1.50
123	Installing embedded elec. nonmetallic conduit	3,900 lf	0.53	1.30
124	Installing ground wires and ground rods	1,600 lb	2.00	0.35
125	Transporting freight of all kinds for Goverment or its agents, other than the contractor, between railroad station and power plant site	400 ton	10.50	9.00

Schedule 3—Marys Lake Penstock Gate Structure, Penstock and Spillway and Estes Penstock Gate Structure and Penstock

DESCRIPTION: (a) The Marys Lake penstock gate structure will be of reinforced concrete directly connected to the outlet portal of Rams Horn Tunnel and ending at the anchor block at the upper end of the steel penstock. A 3-barrel siphon spillway takes off from the right side and leads to a 6 ft. x 6 ft. wasteway conduit which conveys the water to Marys Lake Reservoir well way from the power plant. A fixed-wheel gate will control the flow into the penstock. A concrete building will enclose the portion of the gate structure containing the trashracks, fixed-wheel gate, and siphon spillway inlets. The penstock will be a 96-in. interior diameter steel pipe. (b) The Estes penstock gate structure will be a continuation of the transition at the outlet end of Prospect Mt. Tunnel and will provide separate entrances to the three penstocks. Three 6 ft. x 7½ ft. high-pressure gates will be installed as closures for the penstocks; a concrete building will enclose the portion over the gates. The penstocks will be 78-in. interior diameter steel pipe.

BIDS: Two bids were received January 15, 1947 on Schedule 3. Contract was awarded to the low bidder.

1. Morrison-Knudsen Co. Inc. Boise, Idaho and Peter Kiewit Sons Co., Omaha, Nebraska — $970,968.50
2. Winston Bros. Co. and Al Johnson Const. Co., Minneapolis, Minn. — 976,957.00

	Item	Quantity	Unit Prices (1)	(2)
126	Excavation, common	18,200 cy	$2.75	$0.30
127	Excavation, rock	51,700 cy	2.75	2.00
128	Hauling excess rock excav. material from the Estes Power Plant penstock excav	50,000 cy	0.40	0.65
129	Backfill	28,050 cy	1.00	1.20
130	Compacting backfill	16,000 cy	4.00	3.40
131	Backfill earth and gravel	3,000 cy	2.25	2.60
132	Riprap	60 cy	7.00	11.00
133	Concrete in penstock gate structure, substructure, spillway, and penstock, anchors, and walls	3,922 cy	40.00	41.00
134	Concrete in penstock gate structure superstructure	245 cy	75.00	105.00
135	Furnishing and handling cement	6,200 bbl	4.40	4.68
136	Furnishing and placing reinf. bars ¾" dia. and larger	579,600 lb	0.12	0.12
137	Constructing control joints	100 lf	2.60	3.00
138	Placing coal-tar-saturated felt roofing compl. with flashing	1,900 sf	0.25	0.16
139	Dampproofing outside walls	35 sy	0.90	1.00
140	Installing glass-block panels	55 sf	1.50	2.20
141	Installing fixed-wheel gate	4,000 lb	0.13	0.09
142	Installing fixed-wheel gate frames and guides	4,800 lb	0.20	0.09
143	Installing fixed-wheel gate hydraulic hoist	3,000 lb	0.20	0.09
144	Installing high-pressure gate	216,000 lb	0.14	0.06
145	Installing high-pressure and fixed-wheel gate hydraulic control apparatus	4,000 lb	0.13	0.33
146	Erecting structural metal framework	100 lb	0.13	0.07
147	Installing rails in concrete	3,200 lb	0.06	0.06
148	Installing overhead traveling crane	12,000 lb	0.06	0.06
149	Installing standard metal pipe, fittings, and valves less than 6" in dia	1,300 lb	0.40	0.33
150	Installing standard metal pipe, fittings, and valves 6" or more in dia	81,150 lb	0.22	0.22
151	Installing trashrack metalwork	41,900 lb	0.09	0.07
152	Installing penstocks	7,100,000 lb	0.045	0.057
153	Installing metal swinging door	195 sf	1.30	2.40
154	Installing metal-sash windows	255 sf	1.30	2.40
155	Installing metal louvers	20 lb	1.30	0.30
156	Installing downspouts and leader boxes	80 lf	1.30	1.40
157	Installing miscellaneous metalwork	30,775 lb	0.34	0.32

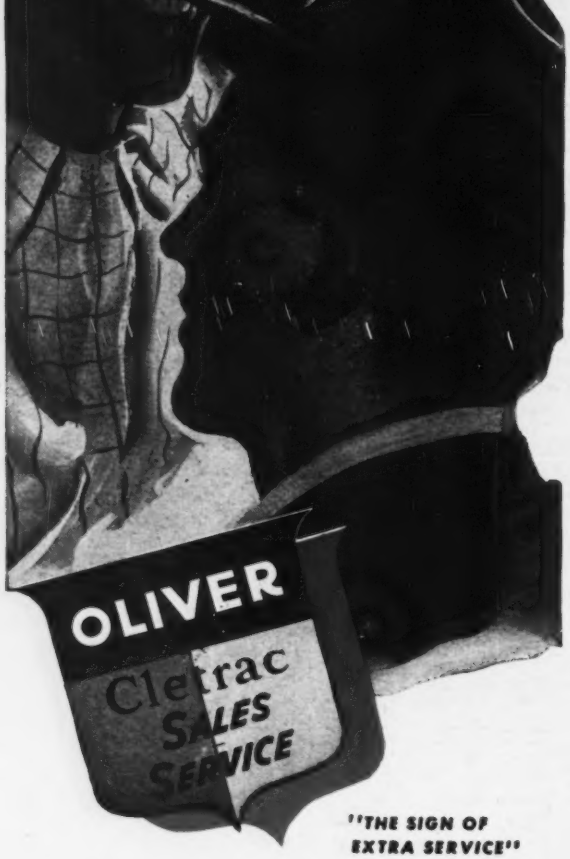
Schedule 4—Aspen Creek Siphon

DESCRIPTION: Aspen Creek Siphon is to be 10 ft. in width and 6 ft. in height, and of reinforced concrete construction. Walls are to be 12 in. in thickness and 400 ft. long. The inlet section contains a trashrack on the overflow channel.

BIDS: Four bids were received January 15, 1947 on Schedule 4, ranging from the contract low of $981,050 to $1,324,677.

1. Horner & Switzer, Denver, Colo. — $981,050.00
2. Morrison-Knudson Co. Inc., Boise, Idaho, and Peter Kiewit Sons Co., Omaha, Nebraska — 1,102,755.00
3. S. S. Magoffin Co., Englewood, Colo. — 1,107,885.00
4. Winston Bros. Co. and Al Johnson Const. Co., Minneapolis, Minn. — 1,324,677.00

	Item	Quantity	Unit Prices (1)	(2)	(3)	(4)
158	Excavation, common, for structures	50,000 cy	$1.84	$1.75	$0.75	$1.07
159	Excavation, rock, for structures	85,000 cy	1.84	1.75	2.25	2.85
160	Backfill	102,000 cy	0.55	0.70	1.00	0.75
161	Compacting backfill	1,000 cy	5.00	3.50	4.00	6.90
162	Concrete in structures	11,100 cy	35.00	43.00	39.00	54.00
163	Furnishing and handling cement	16,600 bbl	4.20	4.40	4.70	4.68
164	Furnishing and placing reinf. bars ¾" dia. and larger	2,100,000 lb	0.097	0.11	0.116	0.12
165	Placing elastic filler in joints	60 sf	1.00	1.00	1.00	1.15
166	Placing metal water stops in joints	53,400 lb	0.15	0.13	0.30	0.25
167	Installing slide gate and hoist	1,300 lb	0.15	0.13	0.20	0.09
168	Installing miscellaneous metalwork	9,100 lb	0.15	0.34	0.25	0.33



"THE SIGN OF EXTRA SERVICE"

The Dozer Never Sleeps

There seems to be no limit to the number of jobs that little Cletrac Imp dozer can do. Why, it seems that every day we find some new job it fits to a "T".

It's been a real time and cost saver, and our Oliver "Cletrac" dealer really rang the bell when he said it would be a "handy man" for our work. He happened to be out one day when we were digging a foundation and remarked about the amount of heavy equipment we had. "You know," he said, "we've got a little unit that might save you a lot of time and money. It's a small hydraulic bulldozer that mounts on the Oliver HG . . . the smallest track tractor in the field. We call it the 'Imp.' It's small enough to do a lot of those jobs without the higher operating costs of a big tractor-dozer unit. And you can get it into places where the big tractors can't operate so you can eliminate a lot of hand labor."

It sounds good to me and it's proved even better. That Oliver "Cletrac" dealer sure has a lot of ideas that make a job easier. He's a good man to know.

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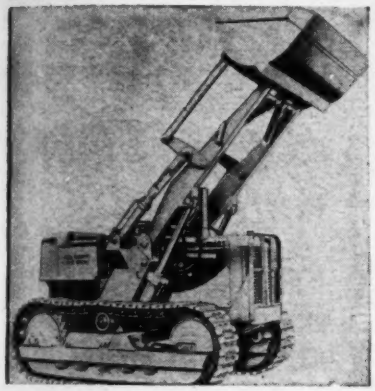
New Aids to the Constructor

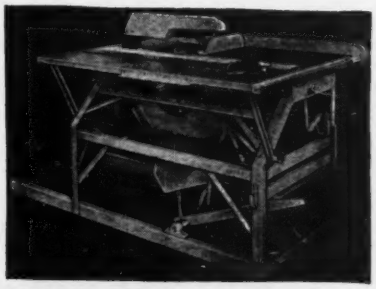
MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

TIES AND FORMS—Plain coil of wire, cut in required lengths, is important factor in assembly of Bulldog forms. No twisting of wire, nailing, bolting or wedging is necessary. Grip tool, manufactured of highly durable material, will make grips in any position. Ties, which can be locked at any angle, will assemble forms and act as positive spreader. When forms are stripped wires can be taken out if desired. Forms have perfectly square butt joints leaving smooth walls that require no finishing. Plywood-faced forms are outlined by sturdily constructed steel frame. Erection time is said to be 10 sq. ft. per minute.—*Bulldog Concrete Form Corp., 100 W. 42nd St., New York 18, N. Y.*

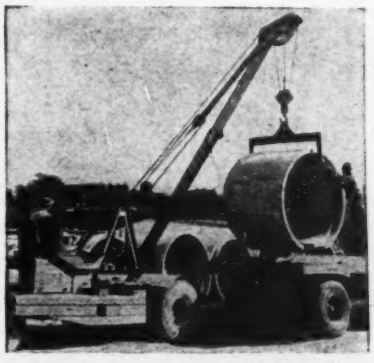


TRACTOR SHOVEL—Model TS-5 Tracto-Shovel for use on Allis-Chalmers HD-5 long track, rigid truck frame diesel tractor is the first in line of tractor equipment that will be built by this company. It has hydraulically-controlled bucket operated by double-acting lift and dumping cylinders. These cylinders are designed to provide adequate down pressure and controlled dumping and closing of bucket. Bucket can be dumped or closed at any height, quickly or slowly, and has automatic tilt-back to prevent spillage.—*Tractomotive Corp., Findlay, Ohio.*

NEW PLYWOOD PANEL—This product, named "Welchboard" after its discoverer, is plywood with a smooth, relatively hard, durable surface which will take a fine finish for either inside or outside construction and will withstand repeated wettings, long-time soakings or even boiling. In the construction field, the product will be useful in the fabrication of interior and exterior walls of homes as the panels can be cut and fastened with ordinary carpentry tools. They are easily sawed, can be nailed or screw-fastened, and the body being plywood, they can be glued to framing members when desired.—*Douglas Fir Plywood Association, Tacoma 2, Wash.*

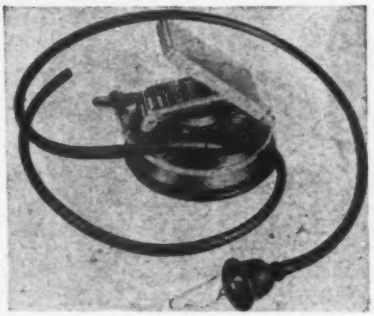


PORTABLE SAW RIGS—Four models of Bearcat portable power saws are now in production. Two basic sizes are offered, each supplied in either tilting-top or fixed-top models. Models XCO (tilting-top) rip or cut off up to 9 in. thick with saw diameter up to 24 in. These two models require 5 to 20 hp. motors or engines. Fabricated steel table-tops are 43x54 in. Models XJR (tilting-top) and JR (fixed-top) rip or cut off stock up to 4 in. thick and use motors or engines from 1½ to 8 hp. —*Paxson Co., Dowagiac, Mich.*



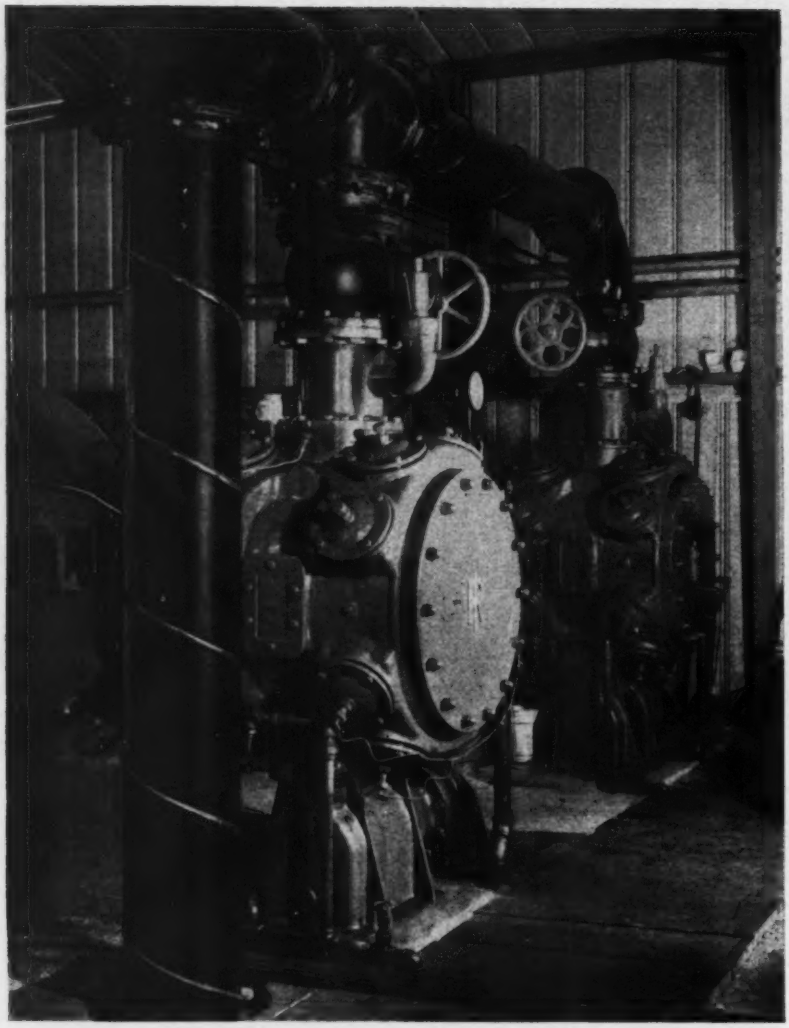
MOBILE CRANE—Krane Kar, mobile power swinging boom rubber-tired crane, can be used inside plants and outdoors. Because it is equipped with large traction and steering wheels, it is capable of negotiating average outdoor roadways around plants and yards. One engine, gasoline or diesel, provides power for crane mechanism and for traveling. Unit can negotiate grades up to 15 percent under load. It is available with electric magnets or clamshell buckets in three standard sizes, 5,000-lb. capacity, 10,000-lb. capacity, and 20,000-lb. capacity.—*Silent Hoist Winch & Crane Co., 841-877 63rd St., Brooklyn, N. Y.*

TIRE AND FIRE UNIT—A new device is a small cylinder labeled "Ford Emergency Tire and Fire Unit", and comes complete with hose attachment for inflating tires. It contains 10 ounces of carbon dioxide under pressure—enough to put out an oil or gas fire, or inflate three average size tires. Exhausted cylinders can be exchanged for loaded ones.—*Ford Motor Co., Dearborn, Mich.*



"POCKET" FILTER PLANT—Construction crews and groups traveling away from approved public water supplies can now be sure of safe drinking water wherever they go, because of a pocket-size filter plant called the Mini-Filter. This device includes a hand pump and filter together with a purifying kit (Aqua-Tabs) in a unit weighing less than 5 lb. The principle of operation is the same as that used by municipal filter plants.—*Wallace & Tiernan, Belleville, N. J.*

EXTRA-DUTY FLEET MOTOR OIL—Cleaner engines, more power, improved gas and oil mileage, and smoother, more dependable lubricating performance are claimed as advantages gained from the use of this product, called Amalie E-D, by gasoline-driven fleets. New oil is designed to protect against carbon and varnish formation, sludge deposits, bearing corrosion, and breakdown or deterioration of the oil itself. Other properties: Ability to prolong oil filter life, end dry starting, overcome foaming troubles, and purge and wash away harmful products of



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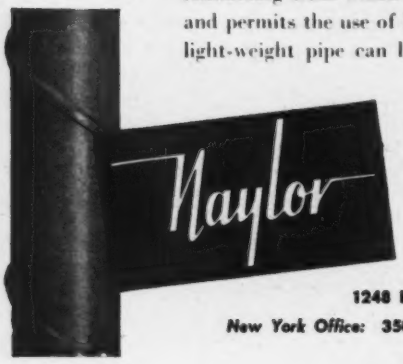

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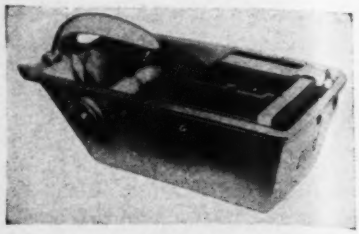
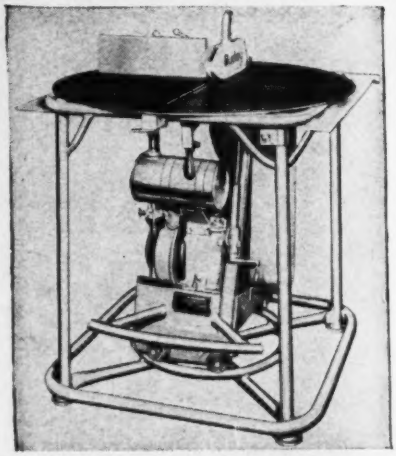
combustion.—*Amalie Division of L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.*



TILE-CUTTING MACHINE—Equipped with a power-driven 8-in. diamond saw, this machine for use in rapid on-the-job tile cutting, combines portability with low power requirements. It has cast aluminum housing and weighs, without motor, 28½ lb. Dimensions, 11x21x26 in. Cuts all standard sizes of tile. Protractor to enable cuts at desired angle and mitre guides are provided for bull-nose and cap-tile mitering. — *Hyatt Lapidary Equipment Co., East San Diego, Calif.*



PORTABLE SAW—Outstanding feature of new saw is rotating table. Circular table top and saw mechanism rotate as unit. With this design, various cuts are made by simply rotating table. When changing cutting angle from ripping to cross-cutting to mitering, it is only necessary to rotate table to desired angle, drop lock pin in place and make cut. *Nordberg Mfg. Co., Milwaukee, Wis.*

PLASTIC-TYPE COATING—A new type of black, cold-applied protective coating with many unusual properties is known as Bituplastic. It is a dispersion in water of highly-refined plastic coal tar pitch and other finest quality materials. Because of its unusual composition it can be applied to damp

Warehouse Fabricated from Scrap with Arc Welding

by **PAUL HICKMAN, Chief Engineer**
Richmond Engineering Co.
Richmond, Va.

UTILIZING a pile of scrap plate, the Richmond Engineering Company, Richmond, Va., provided work for its shop force during the reconversion period immediately after the war, and has economically constructed a large all-welded addition to its plant.

All structural shapes — channels, angles, tees and building columns — were produced by shearing, forming and arc welding flat plate scrap accumulated from the company's war contracts.

The addition, for warehousing steel, is 80 x 300 feet, with 39 feet clear under the roof trusses. The trusses span 70 feet, with the additional ten-foot width provided by a lean-to on one side.

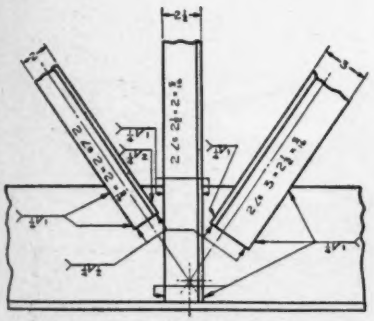


Fig. 2. Detail of top of truss section.

Welding Sequence Controls Distortion

The roof trusses (see Fig. 1) were assembled and welded in jigs, with a planned welding sequence to prevent distortion. Chords for these trusses are continuous I- and T-sections welded from plate. Bracing, eave trusses, struts and purlins are angle and channel shapes also made from welded-up plate. Sketch (see Fig. 2) shows welding details of top section of roof truss.

All trusses, columns, girts and bracing were shop-fabricated. Only the erection work was done at the job site (see Fig. 3). Field erection joints were designed for welding attachments.

Columns were built up from plate by fillet and plug welding and fillet welded to trusses at panel connections.

Galvanized Siding

The warehouse was finished with corrugated galvanized sheet metal siding. Built-up roof has roofing paper, tar and gravel over wood sheathing.

Fig. 1. Roof trusses made from welded scrap plates.

How factory buildings and other types of structures may be designed to take advantage of the greater strength and economy of arc welded construction is described in "Studies in Structural Arc Welding", issued periodically by Lincoln Electric. These Studies are available free to architects and engineers who write The Lincoln Electric Company, Dept. 255, Cleveland 1, Ohio.

Fig. 3. Weld-fabricated column strut being erected.

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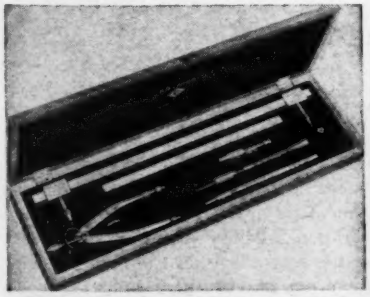
surfaces whether metal, concrete or masonry, by brush or spray, drying quickly by evaporation. It is virtually incombustible and is actually a fire retardant. — *Wailes Dove-Hermiston Corp., Westfield, N. J.*

80-TON REAR-DUMP TRUCK—This 40-ton capacity unit, recently completed by Euclid's experimental department, is powered by a 12-cylinder Supercharged Cummins Diesel engine of 550 hp. Front tires are 18x24; eight tires on the two drive axles are 16x32. Manufactured by Goodyear Tire and Rubber Company, they measure 5 ft. 6 in. in dia. Gross weight of the truck with capacity payload is approximately 80 tons. Still in the experimental classification, truck is being tested on the Mesabi Iron Range in Minnesota.—*The Euclid Road Machinery Co., Cleveland 17, Ohio.*

RUBBER TIRED ROLLER—Compaction unit of 100-ton capacity is equipped with five, 36-ply Goodyear earthmover tires—three on the rear and two on the front. This feature of design distributes the load equally on all tires and permits them to track in staggered formation. The manufacturer states that new records have been established for speed and efficiency in compactions.—*The Southwest Welding & Machinery Co., Alhambra, Calif.*



DRAWING SET—Instruments in a new drawing set consist of beam compass with 8- and 13-in. beams; a 6-in.

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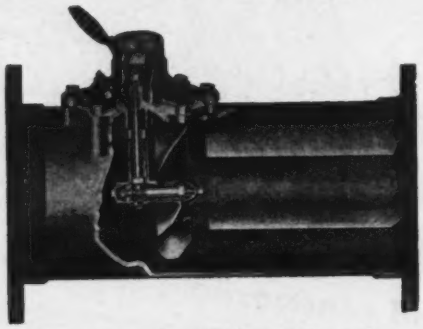

Cutaway view to show the direct action in Sparling Meters. Note the propeller which rotates with the flow and, geared to the Register, gives immediate totalization in any unit desired.

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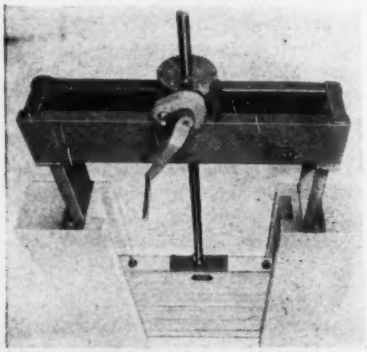
giant bow compass; a ruling pen with club style wood handle and draftsman's refillable pencil that can be converted into a double point pencil.—*Charles Bruning Co., 4754-18 Montrose Av., Chicago 41, Ill.*

LINE MARKER—The "Mark-Rite" line marker operates on gravity feed principle and requires no air pressure, hoses or electrical outlets. This hand-operated marker has self-cleaning valves; large wheels; oversize filler cap. The unit requires only five minutes to set up and another five minutes to clean up. No straining of the paint or lacquer is necessary. Unskilled labor can operate.—*Universal Sales Co., 3062 West Main St., Alhambra, Calif.*



WOOD GATE AND CONTROL—Feature of new gate hoist design is that installation time is cut to the minimum. Positive, self-locking, easily operated control may be installed for either hand or direct-connected electric operation. Bench stands of many capacities lend themselves to ready installation on any of these units. Wood gates are designed for thrust loads imposed.—*Water Controlling Apparatus Division, Rodney Hunt Machine Co., Orange, Mass.*

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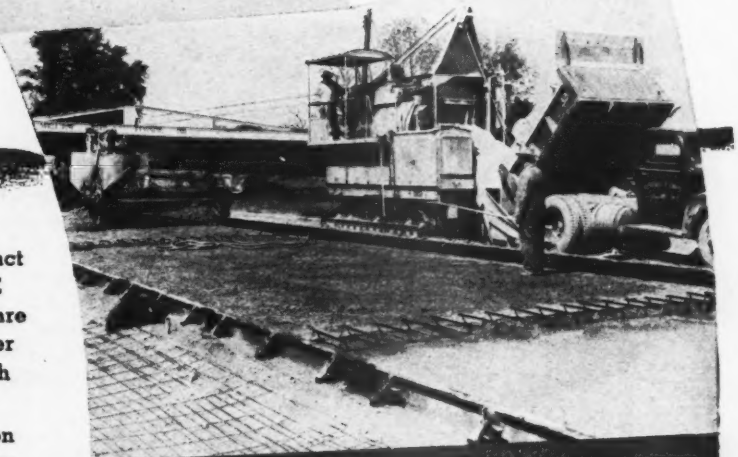
The MULTIFOOTE Duomix a Double Drum 34-E Built by Foote

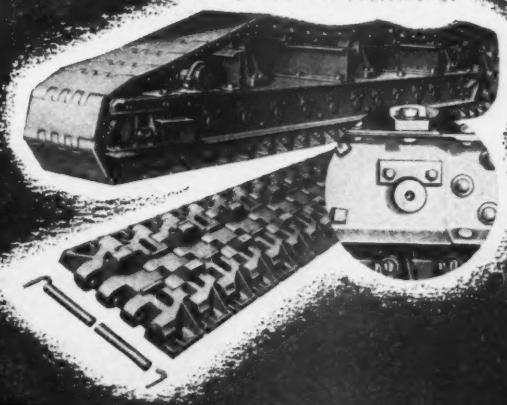


SHOES are wide—plenty of area in contact with the ground keeps the Duo Mix 34-E Dual Drum MuitiFoote up on top. Treads are close fitting, eliminating the nut-cracker action that picks up stones and trash causing cracked treads.

Alternate lugs on treads permit the ejection of dirt giving a self-cleaning type of action.

Roller shafts are keyed into the side frame, eliminating the U-bolt hanger that weakens the flange.

Smooth idler end rollers eliminate jerky travel action and thereby reduce travel strain on the machine. Back this with simple adjustment and rugged construction and you have a crawler no other paver can equal. It's another one of the reasons why the MultiFoote Duo Mix 34-E Double Drum Paver is the smoothest, fastest Double Drum job on the road today. Let us send you details.



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Men and Jobs

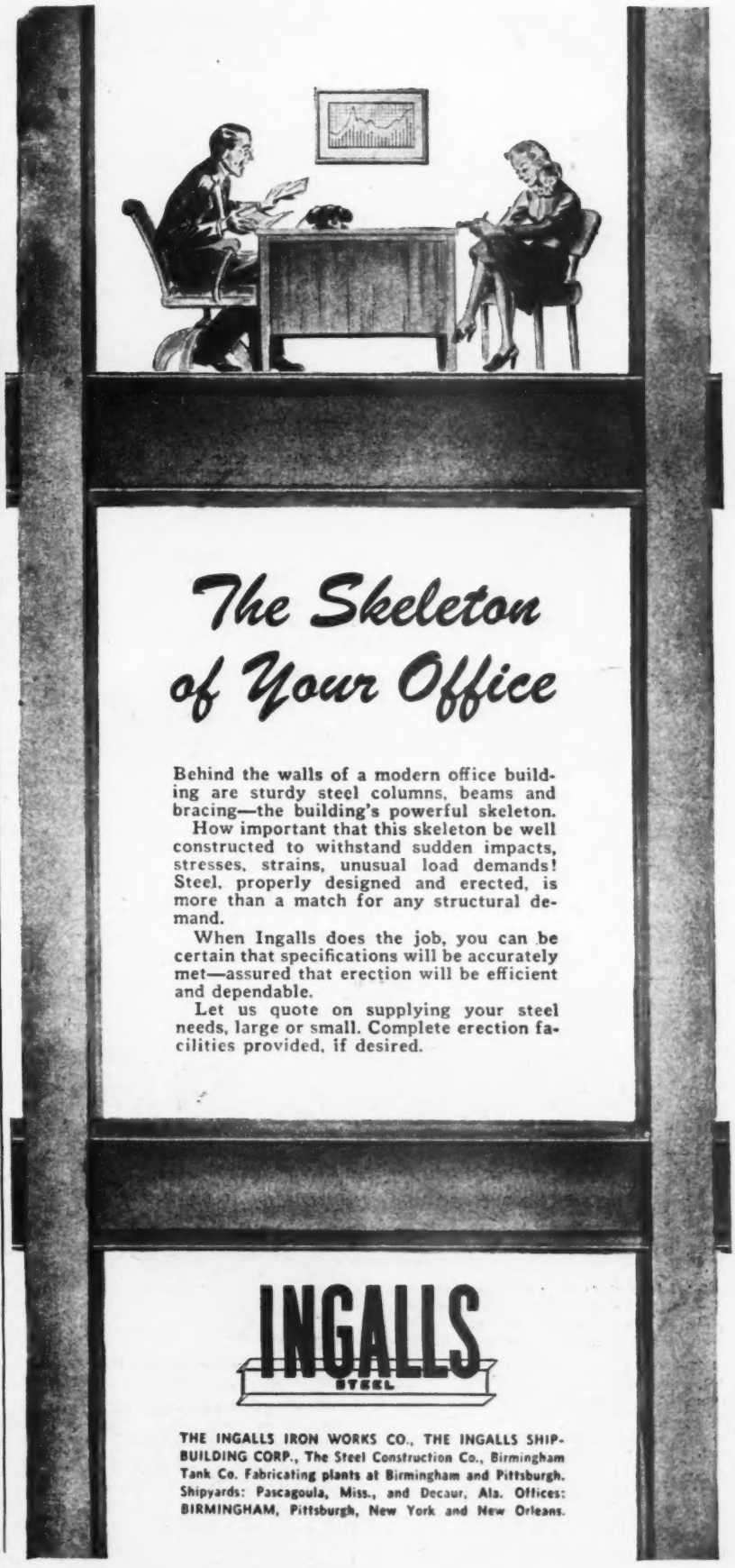
Richard Lee, Corps of Engineers, has gone to St. Louis, Mo., to become deputy division engineer to Col. Clark Kittrell, division engineer of the Upper Mississippi Valley division. He attended the Virginia Military Institute, later entering West Point from which he was graduated in 1918. During the last war he was executive officer at Fort Belvoir, Va., the engineer school and engineer training center; also island engineer at New Caledonia; engineer, South Pacific Base Command; commanding officer, Construction Corps of the Philippines; and chief engineer of the American Forces in the Western Pacific. He has had much experience in river and harbor work, having held assignments at Washington, D. C., Memphis, Tenn., and Ocala, Fla., on the Florida Ship Canal. Colonel Lee also was stationed at Fort Peck, Mont., during the last four years of construction of the Fort Peck Dam.

Lt. Col. W. Ralph Floyd, Jr., has been appointed to the city engineering staff of Utica, N. Y. He was an assistant city engineer prior to 1941 when he entered the service. He served overseas as executive officer of the 37th Signal Heavy Construction Battalion.

F. D. Gifford, of North Bay, Ont., has been appointed town engineer to Waterloo, Ont. Recently he has been on the engineering staff of the Department of Transport. W. L. Bradley who was recently appointed assistant town engineer will continue under Mr. Gifford.

Deforest Pemberton, Columbus, has been placed in charge of a personnel safety program inaugurated by the Ohio Highway Department. Four regional supervisors to aid him were named: **F. L. Schilling,** Ada; **Orry R. Fox,** Upper Sandusky; **Xavier North,** Lorain, and **Ralph H. Shellhouse,** Dayton.

Maj. Blase Nemeth has received orders to report to Fort McPherson, Ga., for separation, it was announced by the office of the Corps of Engineers in Jacksonville, Fla. As executive officer in that district since 1944, Major Nemeth served under the recently retired district engineer, Col. A. B. Jones, and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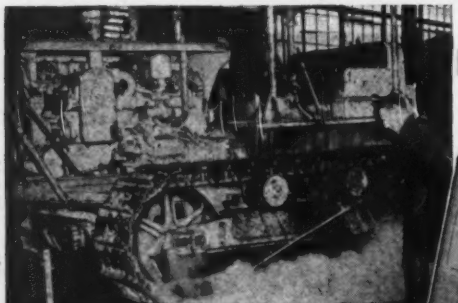

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assisted him in completing the military construction and supply program, as well as directing river and harbor maintenance and advanced planning work. Since last February, he continued his assignment as executive officer under Col. Willis E. Teale, the new district engineer for Peninsular Florida. He went to Jacksonville as a civilian engineer in 1941 from the Buffalo, N. Y., and Milwaukee, Wis., districts. Later he was appointed first lieutenant, Corps of Engineers, and subsequently named area engineer on military construction at Miami 36th Street Airport, MacDill Field, and Orlando Air Base. He received his degree in civil engineering from Ohio State University. Major Nemeth will be associated with the Concrete Products and Engineering Co., Jacksonville.

Newly employed by the Illinois Division of Highways as engineering aides are the following vetenans. **John Celba,** Mundelein, District No. 1; **Arthur Frederickson,** Elgin; **Raymond W. Kluska,** Elgin; **Fred W. Radloff,** Elgin; **Robert Smith,** Belvidere; for District No. 2: **Carl P. Nelson,** Rockford; for District No. 8, **Bernard C. Jankowski,** Nashville; and **Leo E. Travers,** Shipman; **Robert C. Wagner,** Hillsboro; for District No. 9, **Richard R. Roberts,** Murphysboro.

Charles H. Boggs has been appointed District 2 engineer of the West Virginia State Road Commission with headquarters at Huntington to fill the post vacated by **J. N. Smith.** Boggs has been connected with the road department for 25 years, most recently as District resident engineer.

K. S. Lane for last 7½ years soils engineer, Providence, R. I., district, Corps of Engineers, is now chief, soils and geology branch, on design of Garrison Dam, Bismarck, N. D.

Roy O. Papenthien, formerly a lieutenant colonel in the Corps of Engineers, Army of the U. S., has resumed the practice of engineering and architecture at 720 No. Jefferson Street, Milwaukee 2, Wis.

Thomas J. McBreen of Silver Spring, Md., has been appointed editor of the *American Engineer,* official publication of the National Society of Professional Engineers. He has had 15 years of editorial and public relations experience in Washington, D. C. He directed public relations and education programs

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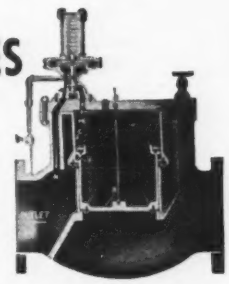

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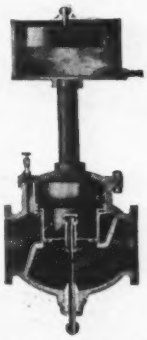

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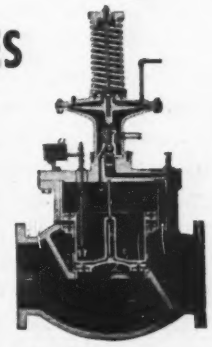
ALTITUDE VALVES

Installed in influent line to tanks, standpipes or reservoirs having a separate discharge on by-pass for service distribution, the valve maintains a uniform water level between 3 inch to 12 inch variation and by means of "stop-starter" switch stops pump.



GA

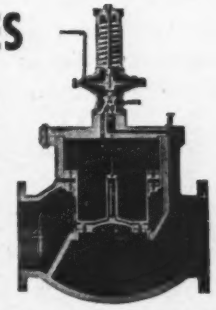
GOLDEN-ANDERSON

STANDARD

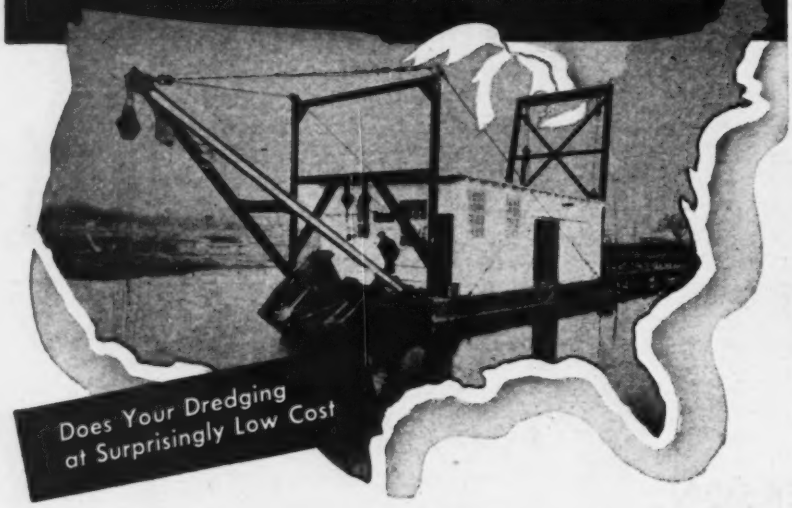
SINGLE-ACTING

ALTITUDE VALVES

Where a separate discharge line or by-pass arrangement is used for removing storage water, the valve is placed in the upstream pressure line and will maintain a uniform water level in tank, standpipe or reservoir within a range of 3 inch to 12 inch.



The Morris PORTABLE DREDGE Is EASILY MOVED From Job to Job



Engineers recommend the Morris Portable Dredge because it can be dismantled quickly and moved from one job to another with minimum expense. Does its work rapidly on inland jobs often inaccessible to regular dredging equipment. Operates with only one man, requires only two or three men for manipulating the pipe line.

You Can Use the Morris Portable Dredge on Many Inland Jobs

It cleans water storage reservoirs . . . Deepens lakes and channels . . . Restores eroded beaches . . . Fills in undesirable lowlands . . . Beautifies parks and lakes. It does not disturb solids as much as other dredges . . . nor does it cause excessive turbidity. In fact, in most cases, reservoir water is usable even during the dredging operations.

Order a Morris Portable Dredge Now

We shall be glad to send one of our experienced hydraulic dredge engineers to discuss your dredging problems with you. He will recommend the purchase of a dredge only if its use is sound, practical and economical.

Should you require a dredge, we can design and build it now complete with either electric, gasoline or Diesel engine . . . and make installation of dredge and piping all ready for operation. Furthermore, we shall furnish an operator for an initial period of time until your own dredge operator learns operation and maintenance of the dredge.

Get Full Information About Portable Dredges

Write us today for Bulletin 177 which illustrates the Portable Dredge and a wide range of other dredges.

MORRIS MACHINE WORKS • Baldwinsville, N. Y.

Sales Offices in Principal Cities

MORRIS *Centrifugal Pumps*

on the Controlled Materials Plan of the War Production Board.

Robert F. Ewald, of the hydraulic engineering department of the Aluminum Co. of America, has resigned after 35 years' service. He is a civil engineering graduate of the University of Wisconsin. He did preliminary work on the Fontana Dam for the Tennessee Valley Authority.

Harry A. Steingart is general manager of Concrete Housing, Inc., Birmingham, Ala., manufacturers of prefabricated concrete homes. In 1941 as supervising engineer for the Alexandria Housing Authority he was in charge of the government-sponsored prefabricated house experiments. Through the war years several large construction organizations called upon him to direct the construction of thousands of dwellings for war workers.

Deputy City Engineer Charles W. Collison, now serving as secretary of the Niagara Falls Planning Board, has been appointed city engineer of Niagara Falls, N. Y., to succeed **H. Wesley Clark** who will devote his full time to private business interests.

Robert H. Fraser has opened a consulting engineer's office at 154 Nassau Street, Room 2005, New York 17, N. Y. His service will include design of structures, plumbing, heating and ventilating, and electrical work.

John B. Murphy has been appointed to the newly-created position of superintendent of public works in Alexandria Bay, N. Y. This incorporates the former posts of superintendent of water works and streets.

Jacques C. Harrington has been appointed to the newly-created position of second assistant city engineer in Binghamton, N. Y.

William Hoenig, chief maintenance engineer of the Wisconsin State Highway Commission, has been granted a leave of absence because of illness. **Maxwell W. Fischer** has been appointed acting maintenance engineer. He has been the assistant chief of his division.

William B. Webster, consulting engineer, Duanesburg, N. Y., has returned to the Charleston, S. C., District Office, U. S. Engineers, as senior engineer. Mr. Webster will be resident engineer in charge of construction of two Veterans Administration hospitals—a 960-bed neuropsychiatric hospital at Salisbury, N. C., and a 250-bed general hospital

An Aluminum Roof keeps this water tank from sweating its head off

The 3/16" aluminum roof plates of this 500,000-gallon water tank are supported on trusses fabricated from Alcoa Aluminum Structural Shapes. An interior access ladder is built of Alcoa Aluminum Rods and Bars.

When a water tank sweats . . . and they all do . . . it doesn't take long for those drops of water to perforate an ordinary metal tank roof. But a roof of Alcoa Aluminum effectively stops inside rusting. Eliminates the expense and hazards of interior and exterior painting.

The strong, light Alcoa Aluminum Alloys have many applications in structures where light weight and resistance to corrosion are desired. They are one-third the weight of steel, easy to fabricate, and easy to erect. Alcoa Aluminum structural shapes in all common sizes are available.

There are probably places where Alcoa Aluminum can be used to good advantage in the projects you are now designing and building. We'll be glad to help you decide. ALUMINUM COMPANY OF AMERICA, 2108 Gulf Building, Pittsburgh 19, Pa. Sales offices in leading cities.

MORE people want MORE aluminum for MORE uses than ever

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

FULL LOADS

in any kind of digging

in less than two bucket lengths

That's the kind of performance that makes money —and it's the kind that you get when your dragline is equipped with a Page Automatic dragline bucket.

Page Automatics dig right in at the first pull on the load line because they always land in digging position and hold it even with all lines slack. Instant penetration at any depth, 20 feet — 100 feet — or more, assures faster loading. Perfect balance of the bucket helps the digging action. Teeth cannot be lifted off the ground by the pull line. For details, send today for Bulletin 43-B.

New Page Reversible Center Shank Tooth Points secured by a hook bolt will stay absolutely tight.

PAGE *Automatic*

DRAGLINE BUCKETS and WALKING DRAGLINES

PAGE ENGINEERING CO.
CHICAGO 38, ILLINOIS

GUNITE
PNEUMATICALLY PLACED CONCRETE
DENSE · DURABLE · HIGH STRENGTH

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Restoring Disintegrated Concrete
Dam, Dock and Bridge Repairs
Steel Encasement and Fireproofing
Sewer, Water Pipe and Penstock Linings
Stack and Bunker Linings
Wood Pile Casings—Pressure Grouting
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Get in touch with us for engineering data and estimates

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DIAMOND AND SHOT CORE BORINGS — DRY SAMPLE BORINGS

Foundation Testing for Bridges, Dams and All Heavy Structures

Also

Manufacturers of Diamond and Shot Core Drills, Accessories and Equipment

SPRAGUE & HENWOOD, Inc.
Scranton, Pa. Dept. E, U. S. A.

at Greenville, S. C. From 1942 until 1944, he was in charge of building construction for the Charleston, S. C., District. From 1944 until 1947, he was employed by Reconstruction Finance Corporation as supervising engineer in charge of projects in Alabama, Ohio, Kentucky, Pennsylvania and New York. Mr. Webster is a graduate of Rensselaer Polytechnic Institute.

O. I. Logue, acting engineer of Works, Saint John, N. B. has resigned.

Keith F. Jones, formerly with the Washington State Highway Department at Tacoma for 15 years, has been appointed Jefferson County engineer at Port Townsend, Wash. He succeeds Jack Lay, who resigned. **Harvey S. Christian** will be in charge of engineering office operation.

Judson F. Vogdes, Jr., has opened engineering offices at Room 315, Broad Street station, Philadelphia 2, Pa.

D. B. Gumensky has left the U. S. Corps of Engineers, Sacramento, Calif., to become principal design engineer with the National Resources Commission of the Chinese government, headquarters at Nanking, China, to work on hydroelectric development. He has had extensive experience in structural design which included work for California irrigation districts, on the Metropolitan Water District and on underground fuel storage for the Navy.

Leonard E. Bates, Waycross, Ga., has been named maintenance of way engineer for the Atlantic Coast Line Railroad, southern division, with headquarters in Jacksonville, Fla. He is a graduate of Georgia Tech.

John A. Nicholls has been named field engineer in the Youngstown, Ohio, public works department. He was recently an assistant engineer in San Jose, Calif., and previously city engineer in Kent, Ohio. He succeeds **Charles A. Wilson,** retired.

Jackson D. Green has resigned as drainage engineer for the Soil Conservation Service at Orlando, Fla., and is now engaged as a land surveyor in New Jersey. A civil engineer graduate of the University of Pennsylvania, 1943, he was in the Navy's CEC in combat at Saipan, Guam and Peleliu. Since discharge as lieutenant (jg) in September, 1945, he has worked for United Engineers and Constructors in Connecticut and Eastern Construction Co. in Trenton, N. J.

Robert W. Eddy is a sanitary engineer for the Board of County commissioners at Palm Beach, Fla.

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

IT'S A SHAME TO DIE SO YOUNG!

CONVENTIONAL AIR HOSE is seldom discarded because it is worn out. Failure usually occurs from rupture of the cotton carcass, breaks near the coupling, or the action of hot oil vapors on the rubber linings.

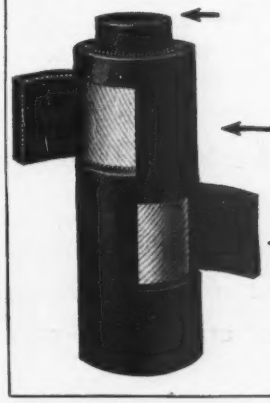
But you'll find a different story in the *different* construction of U. S. Royal Cord Air and U. S. Peerless Compressor Hose.

In both, every cord in each pressure-resistant ply is cushioned in rubber, for protection against bruising. No cord criss-crosses another, consequently no shearing action occurs during pulsation, expansion, and flexing. The high flexibility of "U. S." Hose with the unique cord construction keeps down recoupling jobs.

When compressors throw oil vapors into the lines, U. S. Peerless Compressor Hose is tops . . . has special synthetic rubber lining that cannot be harmed by oil vapors.

Available at your equipment dealer or the nearest branch of United States Rubber Company.

The Unique U. S. ROYAL CORD CONSTRUCTION



Rubber tube compounded for air conditions.

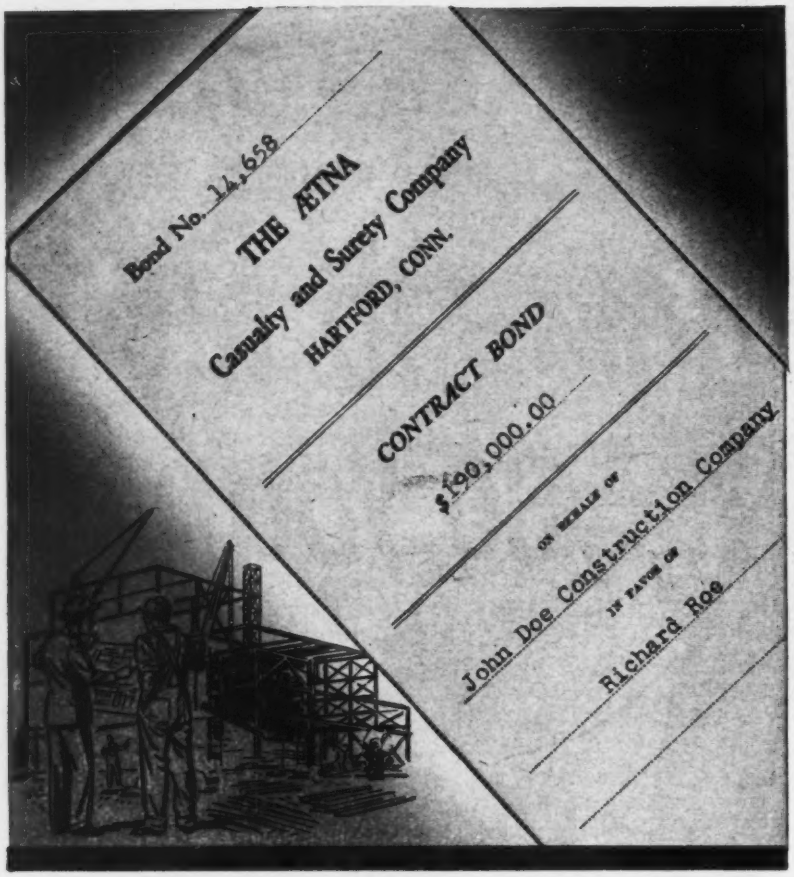
All cords in pressure-resistant plies parallel each other in a cushion of rubber, for protection against bruising. No shearing is possible under expansion, contraction, and flexing.

Tough, thick, wear-resistant cover.

IF HOT OIL VAPORS ARE PRESENT,
use Peerless Compressor Hose. Same cord construction with special synthetic rubber lining oil cannot ruin.

U. S. ENGINEERED RUBBER PRODUCTS FOR THE CONTRACTOR

Air, Water, Steam, Suction Hose · Belts · Packings



Who is your Surety?

From coast to coast, men charged with awarding contracts to the "lowest responsible bidder" know that the bidder who can furnish an Ætna Contract Bond is thoroughly reliable. They know he has satisfied experienced underwriters that he possesses the financial resources, experience and ability to complete a given contract satisfactorily and on time. Usually, they require no other proof of responsibility.

Establish your credit now with the Ætna . . . and you will help assure your bids of favorable consideration by public officials and private owners and architects in all parts of the country.

Agents from Coast to Coast

ÆTNA CASUALTY AND SURETY COMPANY

Affiliated with Ætna Life Insurance Company
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HARTFORD 15, CONNECTICUT

Elections and Activities

Jacksonville, Fla., post of the Society of American Military Engineers has elected Maj. Blase Nemeth, Corps of Engineers, as president. Other new officers are J. L. Ingram, first vice-president; L. L. Burnet, second vice-president; N. A. Holman, secretary, and A. H. Brown, treasurer. The new directorate is composed of John F. Reynolds, retiring president, James I. Haden and L. O. Thornburg.

Roy Tyson, formerly of Bismark, N. D., and an employee of the state water commission for the last six years, has been named county engineer for Traill County, with headquarters at Hillsboro, succeeding E. W. Braasch, who resigned. He formerly was the Devils Lake division maintenance engineer and prior to that with the Reclamation Service.

Jack D. Annand, registered engineer and architect of Portland, Ore., has been elected president of the Oregon Technical Council. K. E. Hamblen is vice-president and Mark M. Clayton secretary-treasurer.

The Montana Contractors Association has re-elected L. M. Sheridan, president; Dan J. Mooney, vice-president, and Rex Fuller, secretary-treasurer. All are from Butte. George Nilson of Great Falls was re-elected director and Morris O'Brien of Great Falls named to the board.

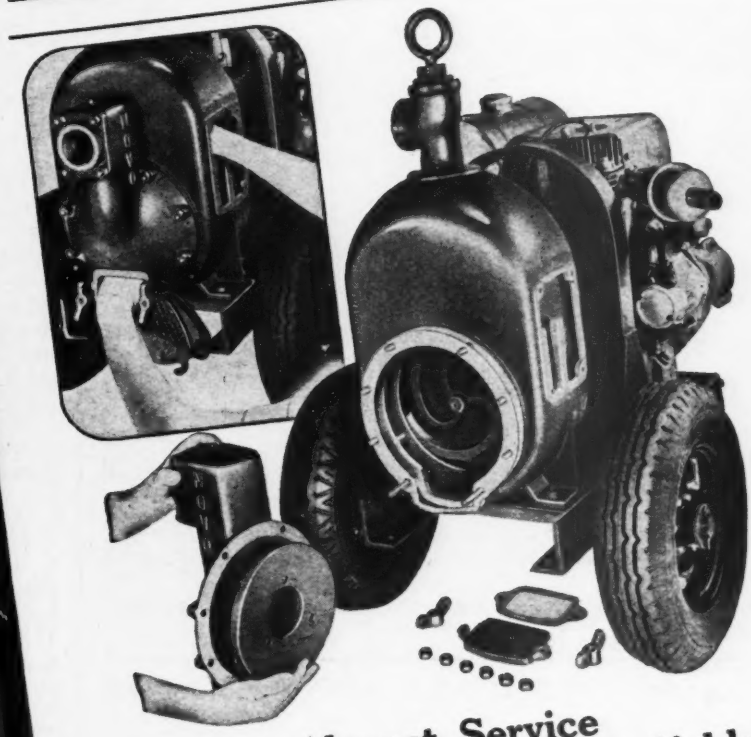
C. E. Canada, sales engineer for the General Electric apparatus department at Portland, Ore., has been elected president of the Professional Engineers of Oregon. Carl E. Green is vice-president; John A. Corenbaum, treasurer; H. O. Ervin and Charles A. McClure, trustees.

Half a century of engineering achievements in Rochester, N. Y., were reviewed recently when the Rochester Engineering Society celebrated its 50th birthday. Edwin A. Fisher, city engineer emeritus, who was first vice-president of the society, was guest of honor. Speakers were Charles F. Kettering, vice-president of General Motors Corp., and Mark Ellingson, president of the Rochester Institute of Technology.

The Puget Sound Flood Control Council at Seattle, Wash., has elected Ray Heath of Seattle as president,

NOVO NEWS

MAY, 1947



You Can Almost Service This Pump Blindfolded!

Servicing a Novo "Pronto-Prime" self-priming centrifugal pump is simple, quick, and easy. It is not necessary to remove the power unit because pump and engine are independent. It is not even necessary to remove the pump case—or disturb the alignment with the engine—because all wearing parts are accessible through convenient openings. Take off the front cover plate and you reach the impeller, wear plate, seal, shaft, and bearings. Or leave the cover plate on and remove the cleanout plate (part of the cover) and you have direct access to the recirculating priming valve.

To check the clearance between impeller and wear plate, take off the hand hold plate on the side. This same opening also enables you to get at the cutoff which is replaceable to provide a ready means of restoring proper clearance with the periphery of the impeller.

These features—together with the proven performance records of this **new and different** pump—mean less "down-time" and more hours on the job.

Other Novo Equipment

Novo contractors' equipment includes diaphragm pumps, pressure pumps, hoists, generator sets, pavement breakers, traffic line-markers, and engines.

NOVO ENGINE COMPANY
LANSING 6, MICH. U.S.A.

CONTRACTOR'S EQUIPMENT
· GRAY IRON CASTINGS ·
ENGINES

Affiliated Manufacturer of A.E.D.

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Phoenix—SMELTER & SMELTER EQUIP. CO.

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North Little Rock—STANDARD EQUIP. and SUPPLY CO.

CALIFORNIA
Oakland and Fresno—MURRAY EQUIP. CO.
Los Angeles—GARLINGHOUSE BROTHERS

COLORADO
Denver—CONDERSON-KRENGEL CO.

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Jacksonville—FARQUHAR MACHINERY CO.
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Tampa—EPPERSON & CO.

GEORGIA
Atlanta—GILL EQUIPMENT CO.

ILLINOIS
Chicago—CENTRAL CONTRACTORS SERVICE
Mt. Vernon—ED MEYER TRACTOR COMPANY
Rock Island—WESTERN EQUIP. & SUPPLY CO.

INDIANA
Indianapolis—DOCK EQUIPMENT CO.
Rochester—DEEDS EQUIPMENT CO.

IOWA
Cedar Rapids and Des Moines—GLOBE MACHINERY & SUPPLY CO.

KENTUCKY
Louisville—NATIONAL EQUIPMENT CO.
Pulaski—HENRY A. PETTER SUPPLY CO.

LOUISIANA
Baton Rouge, Monroe and New Orleans—BONHAM-POSH CO., INC.

MAINE
Portland—EASTERN TRACTOR & EQUIP. CO.
Presque Isle—ROY C. THOMPSON CO.

MARYLAND
Baltimore—MARYLAND SUPPLY & EQUIP. CO.

MASSACHUSETTS
Boston—PERKINS, SEAMANS & CO., INC.

MICHIGAN
Detroit—W. H. ANDERSON COMPANY, INC.
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Marquette—MARQUETTE PUBLIC SERVICE GARAGE, INC.

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Omaha—FEHRS TRACTOR & EQUIP. CO.

NEVADA
Reno—NEVADA TRUCK SALES

NEW JERSEY
Union—SMITH TRACTOR & EQUIP. CO.

NEW MEXICO
Albuquerque—HARRY CORNELIUS CO.

NEW YORK
Albany—VAN NORHUYS PUMP & SUPPLY CO.
Buffalo—FOX EQUIPMENT CO.
New York—H. O. PENN MACHINERY CO.
Rochester—HAVERSTICK & CO.
Utica—CREDLE EQUIPMENT CO.

NORTH CAROLINA
Charlotte—CONTRACTORS SERVICE, INC.

NORTH DAKOTA
Fargo—MYHRA EQUIPMENT CO.

OHIO
Cincinnati—THE FINN EQUIPMENT CO.
Cleveland—PATTERSON EQUIPMENT CO.
Columbus—BLAKE EQUIPMENT CO.
Marietta—NORTHWEST SUPPLY & EQUIP. CO.
Toledo—EDMUND SUPPLY CO.

OKLAHOMA
Oklahoma City—THE BOARDMAN CO.

OREGON
Portland—COLUMBIA EQUIPMENT CO.

PENNSYLVANIA
Philadelphia—METALWELD, INC.
Pittsburgh—BROWNER SUPPLY CO.

SOUTH CAROLINA
Columbia—TIDEWATER SUPPLY CO., INC.

TENNESSEE
Knoxville and Nashville—DEMPSTER BROS.
Memphis—HOWELL EQUIPMENT CO.

TEXAS
El Paso—DON A. CARPENTER CO.
Houston—SOUTH TEXAS EQUIPMENT CO.
Lubbock—FRED BEARDWELL EQUIP. CO.
San Antonio—ACME WIRE AND IRON WORKS
Waco—CONTRACTORS EQUIPMENT SALES & SERVICE, INC.

UTAH
Salt Lake City—THE LANG CO., INC.

VIRGINIA
Norfolk and Roanoke—TIDEWATER SUPPLY CO.
Richmond—INDUSTRIAL SUPPLY CO.

WASHINGTON
Seattle and Spokane—COLUMBIA EQUIP. CO.

WEST VIRGINIA
Charleston—CLYDE W. BROWNER, INC.

WISCONSIN
Milwaukee—STONE MANUFACTURING CO.
Park Falls—STEBER MOTOR SALES

CEMENT GUN COMPANY.

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

This pipe withstood a BEARING STRENGTH TEST of LOAD of 33,000 lbs. WITHOUT CRACKING or DEFLECTING
another pipe not gunited CRACKED and COLLAPSED with load of 17,300 lbs.

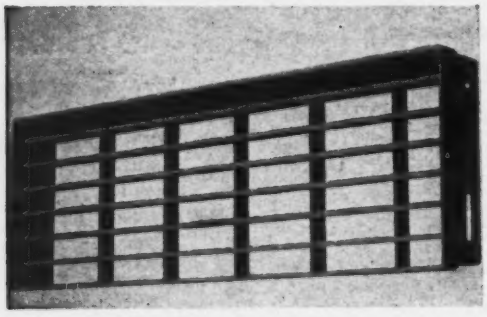
"GUNITE" SAVES SEWER IN CANADA

The pictures tell the story. A 6-months old concrete pipe sewer line at Owen Sound, Ontario was found to be failing under earth load. The tests shown above were made and convinced the city officials that a reinforced "GUNITE" lining would correct the trouble, and we did the job in 1934. The sewer was 36" and 48" diameters and one-half mile long.

"GUNITE" is ideal for lining and strengthening old brick or concrete sewers and has been widely used for this purpose.

Our 72-page bulletin A2300 describes scores of profitable uses of "GUNITE." Write for your free copy.

NOSING BAR HAS DUAL ADVANTAGES



ON

MITCO SHUR-SITE TREADS

Here's a patented, double-value feature of Hendrick Mitco Shur-Site Treads. The heavy, flanged nosing bar makes each step distinctly visible, for accident prevention, and it also provides additional strength at the point of heaviest loading. Shur-Site treads have all the other Mitco advantages, including non-slipping, non-clogging surfaces.

Write for detailed information on Mitco Shur-Site Treads, Mitco Open Steel Flooring and Mitco Armorgrids.

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HENDRICK

Manufacturing Company

45 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

with the following vice-presidents; Ray Syre, Whatcom County; H. O. Walberg, Skagit; Edwin S. Parker, Snohomish; C. Glenn Smith, King; F. H. Essig, Pierce; Ed Berg, Thurston; H. R. Dickenson, Mason; George Thompson, Lewis; Francis Gleason, Grays Harbor, and James Brain, Kittitas. The executive committee consists of Gerrit Veleke, Lynden; Robin Weltz, Mount Vernon; George Duecy, Everett; J. J. Allen, Auburn; Finch Van Slyke, Tacoma; F. W. Mathias, Olympia; Lyle O'Dell, Shelton; Oscar J. Conner, Centralia; John Pearsall, Grays Harbor; and S. J. Dumbolton, Ellensburg.

The Texas Construction Council has elected: C. P. Dodson, Decatur, president; H. R. F. Holland, San Antonio, vice-president; and William P. Glade, Fort Worth, secretary-treasurer. These directors were elected: J. C. Bissett and T. C. Forrest of Dallas; and J. E. Truehart of San Antonio.

At the annual meeting of Builders Exchange of Milwaukee, Wis., these officers were elected: Fred A. Luber president; 1st vice-president, Rudolph F. Forrer, 2nd vice-president, Charles W. Schoenberg, secretary, Anton Heunecke, and treasurer, William F. Eichfeld. Directors elected are:—Edward A. Witzel, Albert M. Vollbrecht and Layton R. Harms.

Fred Veatch has been installed as president of the Tacoma Engineers Club at Tacoma, Wash., with J. Lester Sharp as first vice-president; Carl F. Pflugmacher, second vice-president; John W. Judy, secretary-treasurer, and Col. E. P. Antonovich, executive committeeman.

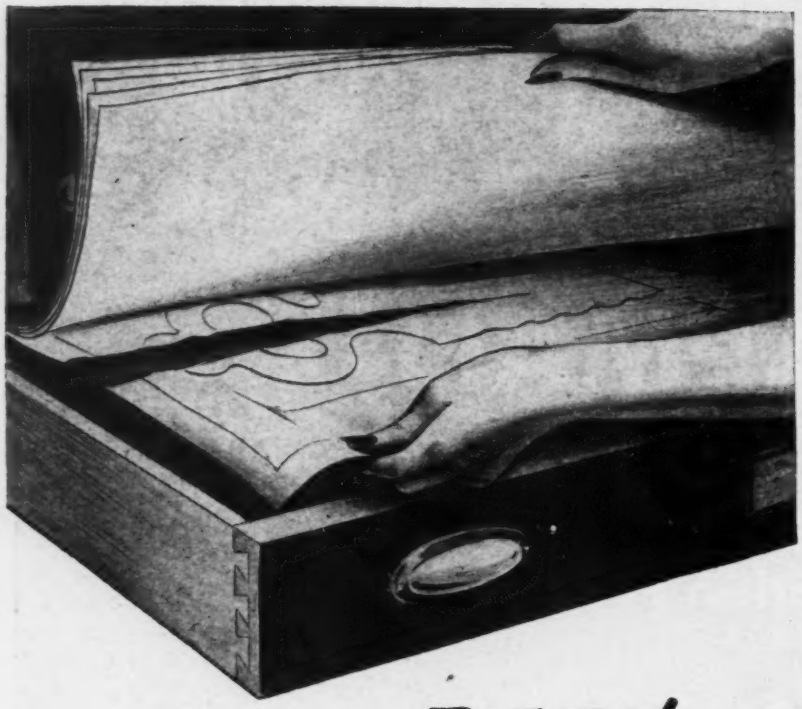
The Home Builders Association of Southwestern Connecticut has elected the following officers: President, Arthur Olson, Darien; vice-presidents, Harold A. Karlsen, Norwalk; William Crowel, Greenwich; secretary, Howard R. Townsend, New Canaan; assistant secretary-treasurer, Harry Trimmer. Directors are: William Crowell, Greenwich, Neale Kelley and William H. Hobby, Stramford; and Harold Karlsen, Norwalk.

R. Stuart Royer, of Richmond, has been elected president of the Virginia section of the American Society of Civil Engineers, succeeding R. A. Marr, Jr., of Lexington. Other officers are: P. A. Rice, Richmond: P. H. McGahey, Blacksburg, and Donald S. Wallace, Charlottesville, vice-president, and John W. Roberts, of Richmond, secy.-treas.

Officers for 1947 of the Connecticut Section, A.S.C.E., elected as follows: President, Philip G. Laurson; vice-

Chapman Standard Sluice Gates are easy to install because their interchangeable stems and couplings require no match-marking. They may be obtained with any type of operating control—manual, hydraulic cylinder or motor unit (completely enclosed in weatherproof housing, and delivered wired—ready for installation) Send for a copy of Chapman's Sluice Gate Handbook for complete information.

THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASSACHUSETTS



r-r-r-r-RIP!

"Embarrassing is no word for it! The big boss wants prints in an hour. He won't understand that this old tracing is dry and brittle, and hit high C when I tried to pull it out of the cabinet in a hurry. All he'll see will be the patch marks. Wonder why he doesn't insist on Arkwright."

Arkwright has a world-wide reputation for staying clear, clean and pliable, year after year . . . no ghost-producing spots . . . no tear-causing brittleness. Special mechanical all-the-way-through processing gives it this ability to laugh off the years. A perfect print was made recently from an 80-year-old tracing on cloth made by the same process now employed by Arkwright.

Why not try Arkwright? See for yourself what a difference there is. Generous working samples free upon request. Arkwright Finishing Company, Providence, R. I.

All Arkwright Tracing Cloths have these 6 important advantages

1. *No surface oils, soaps or waxes to dry out, stain and cause brittleness.*
2. *Erasures re-ink without "feathering" or "creeping".*
3. *Prints are always sharp and clean.*
4. *No pinholes or thick threads.*
5. *Tracings never discolor or become brittle.*
6. *Mechanical processing creates permanent transparency.*

Arkwright

TRACING CLOTHS

AMERICA'S STANDARD FOR OVER 25 YEARS

president, Francis L. Castleman, Jr., and secretary-treasurer, Harold L. Blakeslee.

W. M. Gould, president; E. M. Woolcombe, vice-president; E. A. Saunders secretary, are the new officers of the Constructive Mechanical Trades Exchange, of Halifax, N. S.

Walter E. M. Fieldman has been elected secretary of the Engineering Society of Cincinnati, Ohio, succeeding E. A. Gast, who retired recently after 40 years as secretary.

Leo E. Linbeck of the Linbeck and Dederick Construction Co., is the new president of the Houston, Tex., chapter of the Associated General Contractors of America. Formerly vice-president, Mr. Linbeck succeeds Otis Van de Mark. Robert H. Brown of the Brown Construction Company was elected vice-president and Carl A. Schneider of the Schneider Construction Company, treasurer.

The Niagara Falls, N. Y., Home Builders Association has elected the following officers: Edward Veilette, president; Harold Scott, vice-president; Elwood Treadwell, treasurer; Peter Bowie, Charles Auer, Frank Meogrossi and Albert LaDucca, directors. Walter Johnson was named director ex-officio.

The Wisconsin Road Builders' Association has elected Joseph D. Bonness, Milwaukee, president; Arthur Overgaard, Elroy, vice-president; N. M. Isabella, Madison, treasurer; C. H. Pierce, Medford, recording secretary; and E. E. Hoebel, Madison, executive secretary. The directors are: W. Bechthold, Milwaukee; J. O'Keefe, DePere; and I. H. Pertzsch, Onalaska.

Martin E. Ramsey, was re-elected president of the Sioux City Construction league at the recent annual meeting at Sioux City, Iowa. Edward M. Nystrom was named vice-president; L. S. Wernli, was re-elected treasurer; and Jerome P. Schnabele, was elected executive secretary.

John M. Little, of Union, has been elected chairman of the South Carolina Highway Commission, and B. A. Moore has been chosen vice-chairman. New members of the commission include E. L. Long, of Greenwood, succeeding W. A. Moorehead of Goldville; A. L. Corbett of Wagener, succeeding the late Otis L. Baughman; J. J. Wheeler, of Saluda, succeeding retiring chairman J. L. Caudle; F. Van Clayton, of Pickens, succeeding R. M. Dacus; and L. G. Mishoe, of Greeleyville, succeeding W. G. Deschamps.

Nashville, Chattanooga & St. Louis Railway Corp. T.V.A. Bridge, Camden, Tenn. Consulting Engineers: Howard, Needles, Tammen & Bergendorff, Kansas City, Missouri.

POZZOLITH CONCRETE On *TREMIE* Job...

1. Gave flowability without segregation.
2. Reduced water-cement ratio.
3. Reduced volume change and shrinkage.
4. Provided great durability.

•

Pozzolith makes better more workable concrete, at lower cost, *because it complies fully with the water-cement ratio law.*

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Write for complete information.

OTHER MASTER BUILDERS PRODUCTS IN WHICH CEMENT DISPERSION IS EMPLOYED

EMBECO...
For grouting and reintegration.

MASTERPLATE...
Industry's toughest floor.

OMICRON MORTARPROOFING..
Controls shrinkage cracks, minimizes leaky brickwork, contains stearate.

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CLEVELAND 3, OHIO — TORONTO, ONTARIO

A ONE-MAN CREW
That Will **SAVE MONEY** For You

SYNTRON

100% Self-Contained Gasoline Hammer

PAVING BREAKERS

BUSTING concrete — DIGGING clay and shale
CUTTING asphalt — TAMPING backfill

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SYNTRON CO., 328 Lexington, Homer City, Pa.

MacArthur

37 YEARS INSTALLING PILES
OF EVERY TYPE

CAST-IN-PLACE CONCRETE COMPOSITE
STEEL SECTIONAL PIPE TIMBER
SOIL AND ROCK BORINGS

MacARTHUR CONCRETE PILE CORPORATION
18 EAST 48th STREET NEW YORK 17, N. Y.
BOSTON • CINCINNATI • NEW ORLEANS

Philip H. Chase, chief engineer of the Philadelphia Electric Co. has been elected president of the Engineers' Club of Philadelphia, Pa. Other officers are Andrew C. Muir, vice-presidents and Joseph G. Jackson, treasurer. Samuel Littlejohn, William F. Lotz, Jr., and W. Elmer Titus, directors. Chase succeeds Walter C. Edge.

C. S. Christian of Little Rock, elected president of the Arkansas Engineers Club, succeeds V. E. Scott of Little Rock, who was named chairman of the board of directors. Other officers are: E. E. Mashburn of Little Rock, vice-president; Mike Thomas of Little Rock, secretary-treasurer, and Ray Metzger of Little Rock, steward.

The Niagara Frontier Builders Association has elected the following officers for the coming year: President, William H. Merrill; vice-president, Marvin J. Peterson; secretary, Oscar R. Giesecke, and treasurer, Charles F. Peacock. New directors are G. Lawrence Mitchell, Howard W. Pearce and Philip N. Fleck.

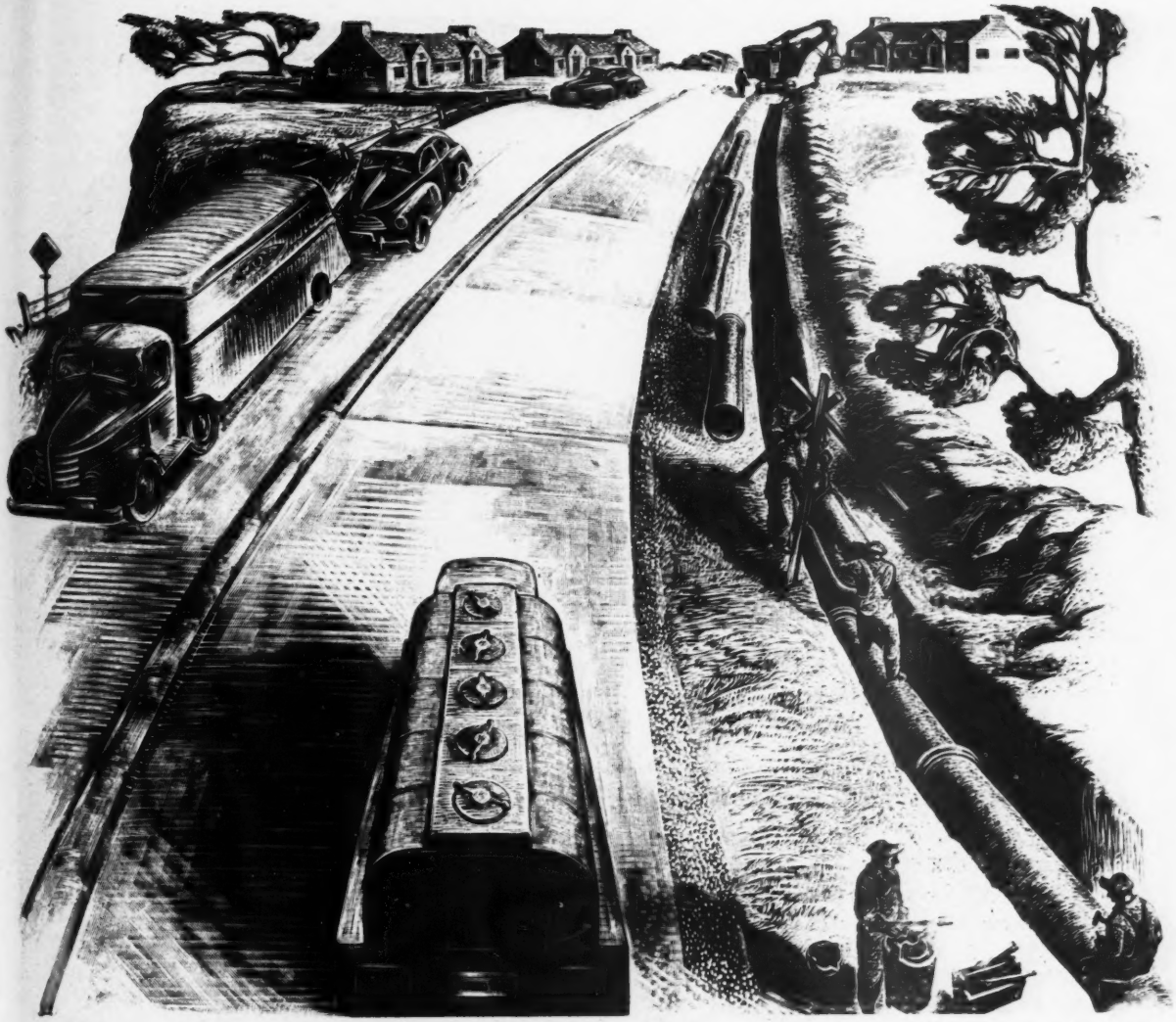
Robert T. Lingle, Raton, N. M., has been elected president of the New Mexico Reclamation Association. An engineer on the Maxwell irrigation project and formerly an organization vice-president, he succeeds Harry Tellyer, Albuquerque, who resigned because of the press of private business.

W. D. Hurst, city engineer of Winnipeg, Man., has been elected president of the Minnesota section of the American Waterworks Association which covers Minnesota, Manitoba, and North and South Dakota.

John D. Coleman, of Dayton, Ohio, has been elected president of the Ohio Society of Professional Engineers. He succeeds Allison C. Neff, Middletown. Other officers are John Heier, Columbus, and Arthur E. Rowe, Cleveland, vice-presidents; J. R. Shank, Columbus, treasurer; and D. W. Converse, Akron, secretary.

Milton B. Schweiger, head of the Schweiger Construction Co. of Kansas City, Mo. has been elected president of the Kansas City Chapter, Associated General Contractors. H. H. Fox of the H. H. Fox Construction Co. vice-president and Gus F. Rau, Jr. of the Rau Construction Co. was elected treasurer. Harry G. Palmer is the executive secretary.

William P. Cornelius, chief of the construction division of the Atomic Energy Commission at Oak Ridge, Tenn., has been elected president of



Original Woodcut by Lynd Ward

When authorizing extensions, utilities must often take the long view in estimating possible revenue. How logical, therefore, to specify long-lived U. S. Cast Iron Pipe for extensions to water, gas or sewerage lines. Cast iron mains not only serve for centuries but they serve at minimum annual maintenance cost—a statement you do not have to take on faith—a statement proved by performance records over many years throughout the world.

U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
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This is my ACCIDENT RECORD

● There is no doubt about it, Hazard LAY-SET Preformed is definitely a safer wire rope for your men to handle. In the first place, when the outside crown wires finally do break, the broken ends remain in place. Being preformed, they refuse to wicker out to become vicious jaggers that tear men's hands and start blood-poison. Many companies have standardized on LAY-SET Preformed because of this single feature. A wire rope that has been kinked or dog-legged is an unsafe rope to use. LAY-SET resists kinking. A wire rope that is hard to handle is more dangerous than the flexible, limber, easy-to-handle LAY-SET Preformed. For safer, faster, steadier production, insist on Hazard LAY-SET Preformed of Improved Plow Steel.

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Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Seattle, Tacoma, Bridgeport, Conn.

HAZARD WIRE ROPE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

HAZARD WIRE ROPE 101 YEARS OLD 1846 • 1947

In Business for Your Safety

the newly-formed sub-section of the ASCE. Warren A. Niles, of the AEC department of public works, was elected secretary-treasurer. Mr. Cornelius, a graduate of Texas A&M, was assigned to the Manhattan Project by the Army in 1943. He was in charge of the construction of the K-25 area. He has served in his present position since his discharge from the Corps of Engineers with the rank of colonel.

Austin Drewry, secretary of Gunnison Homes, Inc., New Albany, Ind., has been elected president of Prefabricated Home Manufacturers' Institute, succeeding Dawson W. Winn of Laurel, Miss.

Toledo chapter of the Ohio Society of Professional Engineers has asked a review of value points given city engineers in the recent city job survey, declaring that city engineers were dissatisfied with their ratings. In an effort to equalize city job values and salaries, the survey was set up to classify jobs with point to have a fixed dollar value.

Officers of the Connecticut Society of Civil Engineers, Inc., have been elected as follows: President, Albert A. Cross, West Hartford; first vice-president, William A. D. Wurts, Hartford; second vice-president, John F. Willis, West Hartford.

Prof. Robert F. Legget of the department of civil engineering, University of Toronto, was elected chairman of the Toronto Branch of the Engineering Institute of Canada at its recent annual meeting. He succeeds Edgar A. Cross, consulting engineer of Toronto. D. G. Geiger, of the Bell Telephone Co. of Canada Ltd., was appointed vice-chairman; Prof. M. W. Huggins, D. C. Beam, and D. D. Whitson were appointed members of the executive committee with 2-year terms. Because of his recent appointment as director of building research for the National Research Council, Ottawa, Professor Legget will hold office only till June of this year, then to be succeeded by Mr. Geiger. The total branch membership is almost 1,200.

Officers of the newly-chartered Southeast Georgia chapter of the Georgia Society of Professional Engineers are: Robert L. Pittman, president; R. T. Littlefield, vice-president; H. D. Watts, Jr., secretary-treasurer; E. A. Logan, state representative, and directors, L. R. Tabor, C. P. Chapman, H. J. Friedman, and W. L. Lee.

On June 19 the New York post of military engineers will make an inspection trip on board the hopper dredge, U. S. Dredge Goethals.

LOW COST CLEARING

WITH A Portable LOWTHER C-SAW

CLEARING — a one-man crew on land clearing. Cuts brush and trees at ground level. Lowther C-Saws will average an acre or more of clearing per day of dense brush and small trees.

FELLING TREES — 30" oak felled in 2 minutes, 52 seconds with Lowther C-Saw. 11" pine felled in 15 seconds. The fastest, most economical tree felling method.

• WORK ANY AREA

Easy to use in cramped quarters where large equipment can't operate—affords better control where selective clearing is required.

• PROVED ON MANY JOBS

Thousands used by logging companies, mines, utilities, contractors, parks, etc. —for clearing brush, trees, cutting construction timber, sawing, piling, etc.

You can see a C-Saw at work near you.

Lowther C-SAW

• SMALL INVESTMENT

Priced under $400.00—will quickly pay for itself on the first few jobs and release heavy equipment for other work.

• LOW COST-PER-HOUR

Carefully kept records of one of the largest utility companies show savings of 50% in clearing operations with a fleet of Lowther C-Saws. Their cost of operation including large depreciation, averaged only 25c per hour. Write for this story!

• ONE-MAN OPERATION

A completely portable saw with its own power plant. One man can easily handle. Equipped with self-propelling "Rototrac" drive for travel over rough, hilly terrain.

BUCKING LOGS—ideal for sawing up construction timber, piling, etc. C-Saws have cut 10-20 cords of wood per day on only 3 gallons of gasoline.

HARRY A. LOWTHER CO. ENR 547
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Send complete information on the Lowther C-Saw, including prices and specifications.

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THE MORSE-STARRETT
WIRE ROPE CUTTER
(HAMMER TYPE)

FAST Especially designed cutting blade and dies assures fast cutting action.

CLEAN Wire rope ends are cut smooth and clean for perfect threading or splicing.

EASY The hammer principle eliminates any special skill requirements.

SAFE The enclosed cutting blade locked in the body of the cutter assures perfect safety.

PORTABLE Models for tool kit or stationary operation. With cutting capacities up to: 1 inch, 1 1/16 inch, 1 1/2 inch.

SEE YOUR DEALER OR WRITE DEPT. "B"

MORSE-STARRETT PRODUCTS COMPANY

1204 - 49th AVENUE, OAKLAND 1, CALIFORNIA

When equipped with a Mall Vibrator, one man can place more concrete than five hand puddlers. At the same time, the concrete placed is denser because a stiffer mix is used . . . is free of voids and honeycombs . . . and has a better bond with reinforcements and between successive layers. Its 1½ or 3 H.P. Gasoline Engine also operates tools for *Grinding, Sanding, Wire Brushing, Pumping, Drilling, Sanding and Sawing.* Electric and Pneumatic models are also available.

Ask Your Dealer or Write Contractors' Equipment Division for Literature.

MALL TOOL COMPANY, 7730 South Chicago Ave., Chicago 19, Ill.

See our advertisement in *The Saturday Evening Post*—June 14th

Mall REG. U.S. PAT. OFF. PORTABLE POWER TOOLS

Manufacturers' Activities

J. A. "JACK" MILLER, prominent in construction equipment sales in Minnesota for more than 20 years, has joined the sales staff of the Koehring Co., Milwaukee, Wis. He will work with Koehring distributors in the North Central states.

CROUSE HINDS Co., Syracuse, N. Y., has completed fifty years of successful service to the electric segment of building construction. An attractive booklet, in a limited edition, tells the story of the achievement, possible only under the American system of free enterprise.

The Shovel and Crane division of LIMA LOCOMOTIVE WORKS, INC., Lima, Ohio, announces the appointment of M. E. Army and Ralph Rodgers as assistant district managers of the Pacific Coast district. Mr. Army will continue to make his headquarters with Smith Booth Usher Co., 2001 Santa Fe. Ave., Los Angeles and Mr. Rodgers will have his office with Paul Fenwick, district manager for the Lima company, with offices at 1315 Howard St., San Francisco.

C. CLARK MOORE has been appointed as export sales engineer of LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Ia., with headquarters in New York City.

THOMAS ROBINS, JR., president of Hewitt-Robins, Inc. of Buffalo, N. Y., and Lester H. Buttenheim, president of McKiernan-Terry Corp. of Harrison, N. J., have just announced an agreement under which McKiernan-Terry acquires the key sales and engineering personnel, good will, drawings, jigs, fixtures and spare parts of Robins Conveyors' Mead Morrison division. Under the agreement, the two companies will cooperate in carrying out important harbor facility projects involving bulk materials handling equipment problem.

NICHOLSON CO., INC., engineers and constructors of bulk storage structures, 10 Rockefeller Plaza, New York 20, N. Y., has opened an office at 38 South Dearborn St., Chicago 3, Ill., to better serve its clients in the Middle West.

SAUERMAN BROS., INC., Chicago, Ill., announces the appointment of Martin Meyer as assistant sales manager. Mr.

McKIERNAN-TERRY PILE HAMMERS chosen for this ingenious, time-saving job

McKiernan-Terry Pile Hammers driving steel H-piles for the new 600-foot pier of Seatrain Lines, Inc. at Edgewater, N. J. The 9-B-3 hammer shown at left is driving batter piles. The 11-B-3 hammer at right is handling vertical piles.

To construct the new Edgewater, N. J. pier of Seatrain Lines, Inc. in shortest possible time, the contractors, J. Rich Steers, Inc. used this unique pile-driving procedure.

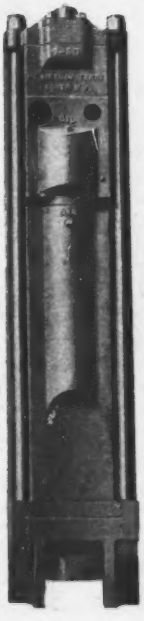
A row of leads, mounted on a barge to correspond with the spacing of a bent of piles, permitted driving thirteen heavy 14-inch steel H-piles without need of moving the barge.

These piles had to be driven in sections and splice-welded. With piles set up in several leads, welding operations in one lead were done simultaneously with driving in another.

For the past fifty years McKiernan-Terry Hammers have been chosen for difficult or complicated pile-driving jobs because of their dependable power, speed and safety. A complete, standardized line of McKiernan-Terry Double-Acting Hammers in ten sizes, Single-Acting Hammers in five sizes and Extractors in two sizes offer the contractor prompt deliveries.

POWER HAMMER FOR BLACKSMITHS

Send for Bulletin 56 describing the McKiernan-Terry Blacker Hammer—the "blacksmith's mechanical helper." Enables one smith alone to handle hand-forging jobs without human helpers around the anvil. Handles jobs faster, with fewer reheats, increasing shop output.



These **FREE** *Bulletins Give Full Information*

Write for McKiernan-Terry Bulletins No. 55 and No. 57 giving specifications, diagrams, advantages, etc., of double-acting and single-acting pile hammers.

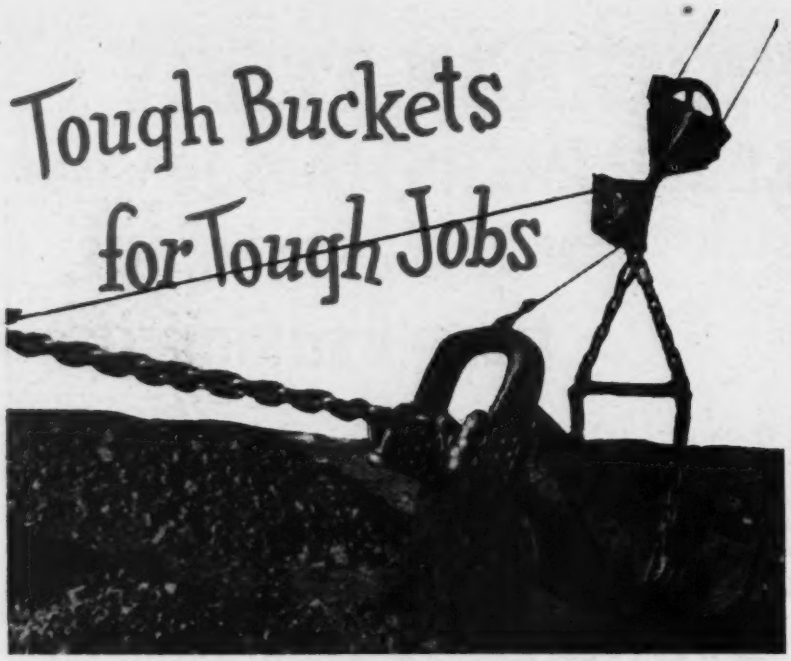
MK-235

McKiernan-Terry CORPORATION

Manufacturing Engineers

13 PARK ROW, NEW YORK 7, N. Y.

Tough Buckets for Tough Jobs



4½-yard ESCO standard weight dragline bucket with vertical pin hitch plates, working on Marion electric. Hitch plate extensions are in upside down position for special pitch adjustment.

If you are like most contractors, you judge a dragline bucket by two measuring sticks:

1. **Will it dig maximum payloads?**
2. **Will it stand up on the job with minimum maintenance expense and loss of time?**

Contractors working on the Grand Coulee irrigation project in Washington state bought their buckets by these standards. *And on this job — one of the country's biggest and toughest — are 21 ESCO buckets used by all six contractors.*

Here's how *ESCO* dragline buckets measure up:

Light Weight—Big Payloads

Weight is reduced without sacrificing strength, through hollow arch construction and use of *ESCO* manganese steel for parts subject to wear and shock. Since this steel work-hardens in use, parts need not be made excessively heavy to allow for wear.

Efficient Digging

Streamlined tooth holders are cast as part of the cutting lip. No bulky tooth holders to offer resistance in digging. Outside tooth holders located in extreme corners of the lip give full bite.

Long life on the Job

ESCO Manganese Steel resists both shock and abrasion, polishes with use, reduces friction. This adds to the life of the bucket, keeps maintenance costs and loss of time at a minimum.

A Bucket to Fit Your Job

ESCO dragline buckets are made in three types — medium, standard and heavy duty. One of these buckets will do your digging job with less trouble and more profit. Catalogs describing these buckets are yours for the asking. Just fill in and mail the coupon below.

ESCO *Manganese Steel*
FOR ULTIMATE ECONOMY

ELECTRIC STEEL FOUNDRY

2167 N. W. 25th AVENUE, PORTLAND 10, OREGON

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ELECTRIC STEEL FOUNDRY
2167 N. W. 25th Avenue,
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Please send catalogs on ESCO dragline buckets to:

Name_____

Address_____ Zone____

City_____ State_____

Meyer has been engaged in both the sale and engineering of Sauerman scrapers and cableways for the last six years and previously was in railroad construction work.

PARK SANDERSON has been appointed manager of the Boston plant of Joseph T. Ryerson & Son, Inc., steel distributors, to succeed Herbert D. Wills, who is retiring. For the past 20 years Mr. Sanderson has been active in Ryerson service and management operations, and has gained the reputation of being one of the best infomed steel men in the New England area.

T. D. COLLINS has been appointed vice president of the International Derrick and Equipment Co., Columbus, Ohio, in charge of supply stores and direct sales in the Mid-Continent, Gulf Coast, Rocky Mountains, and Illinois divisions, with headquarters in Dallas, Tex.

LIQUID CONDITIONING CORP., Linden, N. J., announces the appointment of William O. Lovejoy as its representative in Florida on water treatment processes. Mr. Lovejoy was previously in charge of the Louisville, Ky., water works.

R. G. LE TOURNEAU, INC., Peoria, Ill., has recently made several changes in its domestic sales division. Robert C. Lewis is installation manager for the company; Keith Thompson, applications engineer; O. A. (Jack) Williams is Western sales manager; E. M. Ferguson, Eastern sales manager; C. D. Fey is now industrial sales representative for the entire country. The company's central sales office has been moved to Kansas City, Mo.

WHEELCO INSTRUMENTS CO., Chicago, Ill., have appointed Elmer Schneider vice president and director of engineering. Joseph A. Reinhardt becomes plant manager.

Through a purchase of the holdings of Mrs. F. H. Cutshall and Dean F. Cutshall in the AMERICAN STEEL DREDGE CO., INC., and subsidiary, Walter W. Walb and a group of company executives and local investors have acquired control. Company operations will continue as in the past, and there will be no change in personnel.

J. F. Bachman has been appointed director of FORD MOTOR CO.'s industrial and marine sales department.

Addition of the widely-publicized concrete housebuilding TOURNALAYER UNIT to its sales line, and the formation of the Tournalayer sales division of R. G.

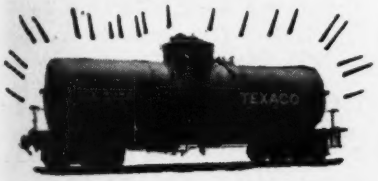
HOT OIL . . .

. . . MAKES FAST WORK OF THAT OILING PROJECT

THE tank-car on the siding is the starting point for fast work on any oiling project. The quicker you get the oil or asphalt up to application temperatures and flowing into the distributors — the faster your road crews can get going.

With a Cleaver-Brooks tank-car heater you have hot dry steam flowing to the car coils from a cold start in 20 minutes or less. And you can keep going all day with the least work and bother because a Cleaver-Brooks tank-car heater asks less in fuel and water. The famous and exclusive four-pass flue travel means low fuel consumption; the turbine type condensate return system cuts water loss — every drop of condensate goes back to the heater under pressure. . . . Built for full capacity — full-time work — Cleaver-Brooks tank-car heaters will give you the most in production hours on the job. Wherever in service, Cleaver-Brooks are usually given the tough jobs because of their known reliability. . . . Write today — get full information from Cleaver-Brooks — the pioneers and originators of tank-car heaters and bituminous boosters.

GET HOT OIL— FAST—WITH LESS WORK—FUEL— WATER



CLEAVER-BROOKS COMPANY
5107 North 33rd Street • Milwaukee 9, Wisconsin

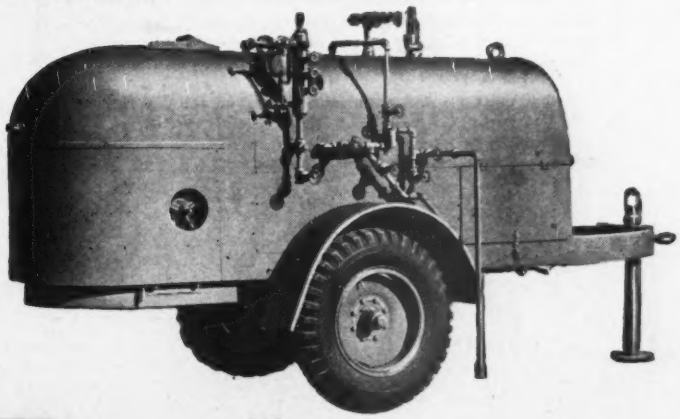
Not just a "boiler on wheels" but a rugged, compact, highly perfected steam generator built by specialists in steam generating equipment.

★

The only tank-car heater with the fuel-saving four-pass flue travel construction. No water problem — full condensate recovery and return to heater under pressure.

★

An all-purpose unit—provides steam wherever and whenever needed — for heating, thawing, cleaning.



Cleaver-Brooks

PIONEERS AND ORIGINATORS OF

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM PLANTS

11 WAYS YOU GET BETTER CONCRETE WITH TRIMIX

Scientifically prepared TRIMIX puts new speed and economy into concrete construction . . . overcomes uncertain human factors present on many construction jobs. TRIMIX is a multi-purpose admixture that has proved its efficiency in actual construction over a period of many years. Because of its exclusive features TRIMIX gives you a denser, richer mix *plus* these 11 important advantages:

1.	Reduces Water-Cement Ratio.
2.	Improves Workability of Mix.
3.	Entrains Air and Increases Resistance to Freezing and Thawing.
4.	Effects Better Cement Dispersion.
5.	Increases Early Compressive Strength.
6.	Shortens Initial Setting Time.
7.	Produces Stable, Uniform Mixes.
8.	Increases Resistance to Water and Erosion.
9.	Reduces Bleeding and Laitance.
10.	Promotes More Thorough Curing.
11.	Aids Cold Weather Concrete Work.

TRIMIX is used extensively in all concrete work (ready-mixed, hand-mixed, Gunite process), stucco construction, mortar mixes, patching and maintenance, grouting, foundation walls and footings, floor construction, integral hardening of concrete surfaces, etc.

See SWEET's for further information, or for descriptive folder write Dept. E5.

SONNEBORN
"BUILDING SAVERS"
Floor Treatments • Waxes • Paints and Protective Coatings • Concrete and Mortar Admixtures • Waterproofing and Dampproofing • Caulking Compounds Roof Coatings
IF IT'S WORTH BUILDING IT'S WORTH SAVING

Building Products Division, **L. SONNEBORN SONS, INC.**, New York 16, N. Y.
In the Southwest: Sonneborn Bros., Dallas 1, Texas

LeTourneau, Inc., has been announced. Richard L. LeTourneau has been appointed manager of the newly created division.

LIQUID CONDITIONING CORP., manufacturers of Liquon processes and equipment for softening and clarification of water and for conditioning of other liquids, and Liquonex water treatment materials, has removed its main office and plant to Linden, N. J. to take care of its expanding business.

W. T. STRATTON has been appointed director of purchases of the Wickwire Spencer Steel Division of the Colorado Fuel and Iron Corp. and will be located at the Curtiss Building, 361 Delaware Ave., Buffalo 2, N. Y.

Plans for a new plant to be constructed in Melrose Park, near Chicago, have been announced by STERLING TOOL PRODUCTS CO., manufacturer of portable sanding machines.

Due to steadily increasing business, the C. I. T. CORPORATION has found it necessary to occupy enlarged offices at North LaSalle Street, Chicago, Ill.

INTERNATIONAL HARVESTER CO. has announced the following changes in branch management; A. C. Lanhan, has been appointed assistant branch manager at Salt Lake City. F. R. Kemple succeeds Mr. Lanham at Indianapolis. L. W. Madery, is assistant manager, Indianapolis, Ind., motor truck branch. A. F. Jackson, has been transferred to Tulsa, Okla. H. E. Broadwell is now assistant branch manager at Billings, Mont. J. W. Cooper has been appointed manager of International's new parts depot at Baltimore, which will open in July.

The opening of a new store and district office to meet the increased demand for welding and cutting gases and equipment stimulated by the considerable industrial growth of the Emeryville, Oakland, East Bay area is announced by the AIR REDUCTION SALES CO. This new retail store, which is located at 1485 Park Ave., began business operations early in February.

INDEPENDENT PNEUMATIC TOOL CO., Chicago, manufacturers of Thor portable pneumatic and electric tools, announces the opening of a technical office at Sao Paulo, Brazil. Reuben P. Rudy is manager of the new office.

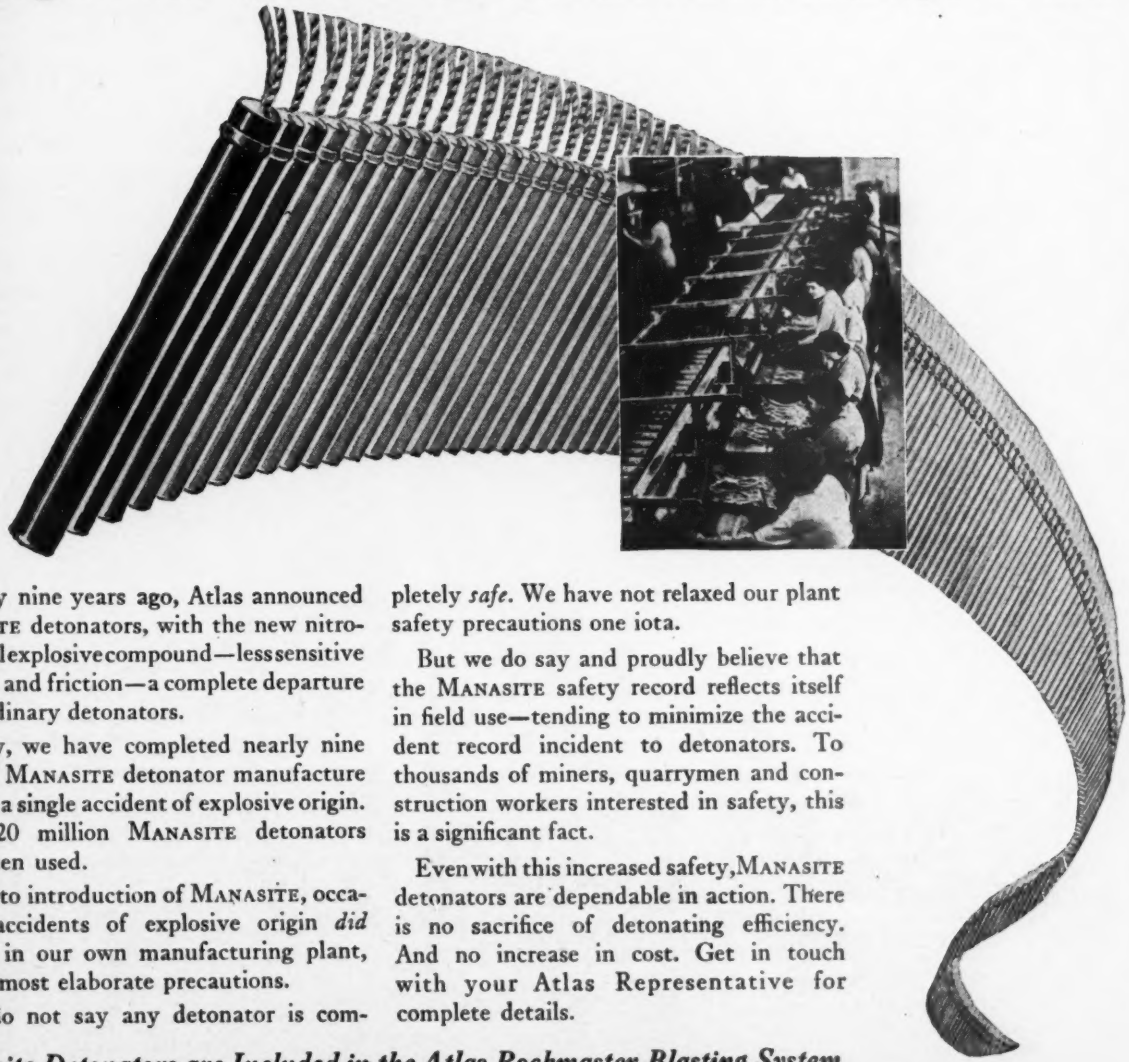
THE CLAY SEWER PIPE ASSOCIATION, INC., announces the appointment of Edward W. Hartman of Akron, Ohio, as district representative for the Ohio area.

NO EXPLOSIVES ACCIDENTS

in the making of

520,000,000 MANASITE DETONATORS

An Eight-Year Record That Means Added Safety For You



Nearly nine years ago, Atlas announced MANASITE detonators, with the new nitromannitol explosive compound—less sensitive to shock and friction—a complete departure from ordinary detonators.

Today, we have completed nearly nine years of MANASITE detonator manufacture without a single accident of explosive origin. Over 520 million MANASITE detonators have been used.

Prior to introduction of MANASITE, occasional accidents of explosive origin *did* happen in our own manufacturing plant, despite most elaborate precautions.

We do not say any detonator is completely *safe*. We have not relaxed our plant safety precautions one iota.

But we do say and proudly believe that the MANASITE safety record reflects itself in field use—tending to minimize the accident record incident to detonators. To thousands of miners, quarrymen and construction workers interested in safety, this is a significant fact.

Even with this increased safety, MANASITE detonators are dependable in action. There is no sacrifice of detonating efficiency. And no increase in cost. Get in touch with your Atlas Representative for complete details.

Manasite Detonators are Included in the Atlas Rockmaster Blasting System

"ROCKMASTER"—Trade Mark; Manasite—Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

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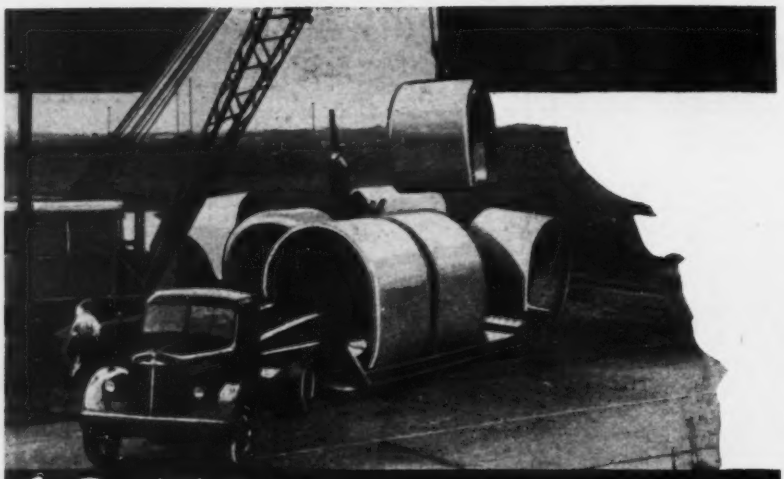

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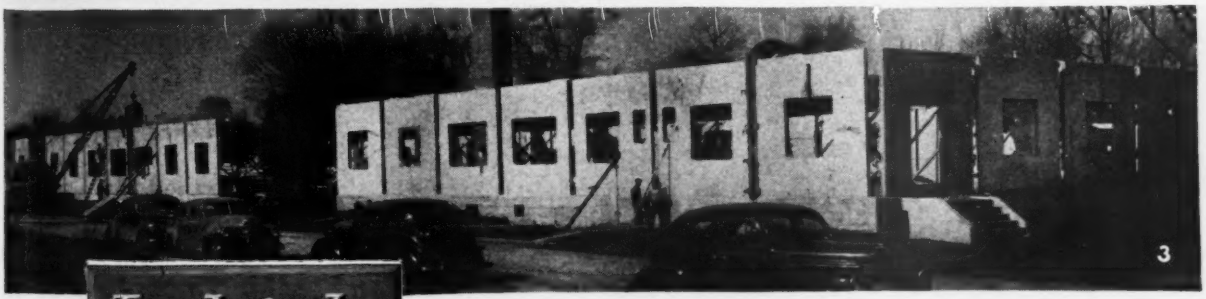
Contractor: H. A. Williams, Allentown, Pa.



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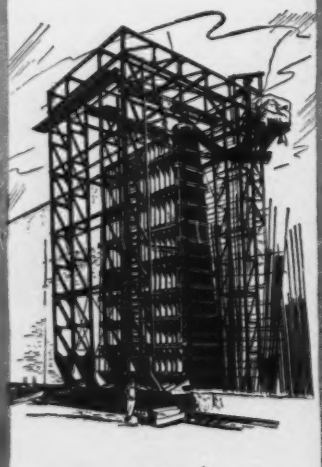

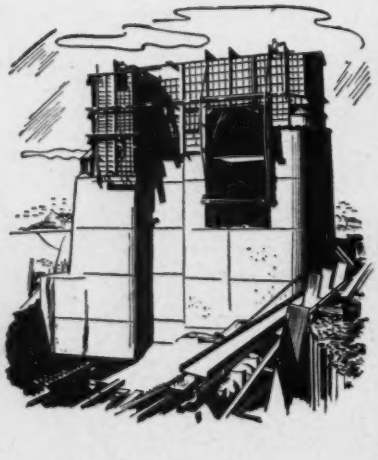

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